ABSTRACTS

FROM

THE METEOROLOGICAL OBSERVATIONS

TAKEN AT THE

STATIONS OF THE ROYAL ENGINEERS

IN THE

YEAR 1853-4.

WITH A

BRIEF DISCUSSION OF SOME OF THE RESULTS

AND

NOTES ON METEOROLOGICAL SUBJECTS.

EDITED BY

LIEUT.-COLONEL H. JAMES, R.E.,
F.R.S., M.R.I.A., F.G.S., &c.

LONDON:
PRINTED BY GEORGE EDWARD EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

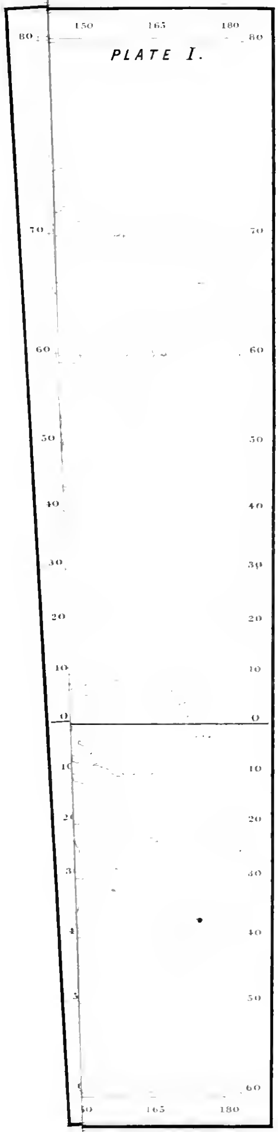
1855.

Shelf 71.

Out of this and other such work has grown the State weather office which publishes weather forecasts in the daily press. Since April 1. 1879 — Bound mended & shelved July 31. 1879.

J. P. Campbell [illegible]

PLATE I.



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NOTE.—*The intention of publishing the Abstracts of the Meteorological Observations in the Corps Papers has been abandoned, not only because it has been found that the size of the pages of that Work will not admit of the Tables being printed in a proper manner, but because it has been thought to be injudicious to load those volumes with a large number of Tables on one subject, and that possibly one in which some of the Officers may take little interest. Authority has, therefore, been obtained to publish the Abstracts in the form in which they now appear.*

This Work has been much longer in the press than I could have wished or intended; but in consequence of my having been recently appointed Superintendent of the Ordnance Surveys, and my removal to Southampton, I have not been able to devote any time to it; and I trust this circumstance will also be received as some excuse for the imperfect manner in which the results have been discussed.

H. J.

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List of Plates.

I.

To Lieut.-General Sir John Burgoyne, K.C.B., &c., Inspector-General of Fortifications.

Sir,

In obedience to your instructions, sets of meteorological instruments, consisting of,—

1 barometer.	1 maximum in the sun thermometer.
1 wind gauge.	1 minimum on the grass ditto.
1 rain gauge.	1 maximum in air ditto.
1 Daniell's hygrometer (to four stations only).	1 minimum in air ditto.
	1 maximum wet bulb ditto.
1 standard thermometer.	1 minimum wet bulb ditto.

were forwarded to the following stations, and the Registers of the observations directed to be taken have been received, from the dates opposite each station.

Bahama	1st September 1852.	Jamaica	21st June 1852.
Barbadoes	1st January 1853.	Malta	1st April 1852.
Bermuda	1st May 1852.	Mauritius	16th November 1852.
Cape of Good Hope	1st September 1853.	Newfoundland	1st August 1852.
Ceylon	1st April 1852.	New South Wales	1st July 1852.
Corfu	1st September 1852.	St. Helena	1st September 1853.
Gibraltar	1st February 1852.	Kingston	1st September 1853.
Guernsey	1st January 1852.	Quebec	11th May 1853.
Halifax	1st August 1852.	New Zealand	1st January 1853.
Hong Kong	1st January 1853.		

The irregularity of the dates from which the observations were commenced arose principally from the irregularity of the periods at which the instruments were forwarded from the Tower to the Stations.

In the accompanying abstracts, which I have made from the registers sent home, a great many gaps appear, especially in the observations for maximum temperature. This arises from the circumstance, that almost all the self-registering maximum thermometers which were sent out became useless after a short time. The liability of these instruments to get out of order, by their indices becoming entangled in the mercury, was well known, and pointed out in the instructions for taking the observations, which were sent with the instruments; but I am in hopes that the new thermometers of Negretti and Zambra, which have now been sent out to replace those first sent, will enable the officers in future to make the series of observations more complete.

The breakage of some of the instruments on their passage out was another cause of delay; and I need not remind you of the frightful mortality at Bermuda, which swept away so many officers, as another cause of the breaks in the observations. The hourly observations are not as yet sufficiently numerous to enable me properly to analyze and discuss the observations received. The remarks I have made on them, as well as the extracts I have inserted from the writings of others, are given with the view of interesting the officers in the science of meteorology, and that they may see the points upon which we require information, and the necessity for regularity and accuracy in making the observations. This latter point will be more effectually attained if all the civil officers at the engineer offices are taught to register the instruments, as the duties of the engineer officers necessarily take them frequently from their offices, and regularity cannot be obtained if the duty of registering the instruments is left solely to them. All the registers and diagrams which have been received are bound up in separate volumes for each year, and so arranged, that the observations taken on any day, at any of the stations, can be readily referred to; and I hope we shall soon have, as we undoubtedly ought to have, a national meteorological office, to which they may be sent for reference.

I have the honour to be,

Sir,

Your obedient servant,

Henry James,

Captain Royal Engineers,

and Brevet Major.

Edinburgh, 17th July 1854.

II. MARITIME CONFERENCE AT BRUSSELS.

Since the establishment of meteorological observatories at our stations two very important events have occurred, which will have great influence on the science of navigation, and enable us to form more just conceptions of the physical laws which govern the circulation of the atmospheric and oceanic currents, and meteorological phenomena in general.

I allude, first, to the results of the proceedings of the Maritime Conference, held at Brussels, in August and September 1853, for the purpose of establishing a uniform system of meteorological observations at sea, and to concur in a general plan of observation on the winds and currents of the ocean, &c.; and secondly, to the balloon ascents of Mr. Welsh, under the direction of the Kew Observatory Committee of the British Association for the Advancement of Science.

The meeting at Brussels, to use the words of the report, "was convened at " the instigation of the American Government, consequent upon a proposition " which it had made to the British Government, in reply to a desire which " had been conveyed to the United States, that it would join in a uniform " system of meteorological observations on land, after a plan which had been " prepared by Captain James, of the Royal Engineers, and submitted to the " Government by Sir John Burgoyne, Inspector-General of Fortifications." This meeting was attended by representatives from Belgium, Denmark, France, Great Britain, Netherlands, Norway, Portugal, Russia, Sweden, and the United States, and the Governments of Prussia and Spain have since expressed their regret that, through some misapprehension as to the time of meeting, they had not sent representatives also. M. Quetelet, the Astronomer Royal at Brussels, presided at the sittings. The representatives on the part of Great Britain were Captain Beechy, R.N., and Captain James, R.E.

By carefully collating the observations on the direction of the wind, and of the currents of the ocean, from the log-books of upwards of 10,000 voyages, Lieut. Maury,* of the United States Navy, has been able to construct a

* National Astronomer at Washington.

series of wind and current charts, which have already proved of the greatest value to navigators.

In constructing these charts, the ocean is divided into spaces of 5° of latitude, and 5° of longitude, and the direction of the wind, which is observed at any given time, in any one part of these districts, is assumed to be that in which it is blowing in every other part: this is the only assumption made. A special chart is appropriated to each month of the year. The course of the vessels during each month is pricked off on the charts, and the direction of the wind and currents in traversing the different spaces noted on them; and in this way, a knowledge of the prevalent direction of the wind and currents in all parts of the ocean and at all periods of the year is arrived at. A pilot chart, on which the results obtained on the separate monthly charts, is then constructed; the results being represented in spaces between the rays of what is called a "Rose," so that the general result is presented at one view to the navigator.

From this brief sketch of the principle upon which the wind and current charts have been constructed it will readily be understood how the Thermal charts of the ocean are constructed, and the course of warm or cold currents, like that of the Gulf stream and that from Davis' Straits, traced out; and how, in like manner, the course of the isothermal and isobarometrical lines can be traced across the ocean.

This system of investigation has been already most fertile in results, and they are thus alluded to by the Secretary of the Royal Society:—"The "routes to many of the most frequented ports in different parts of the Globe "have been materially shortened; that to San Francisco, in California, by "nearly one-third; a system of southwardly monsoons in the equatorial regions "of the Atlantic, and on the west coast of America, has been discovered; "a vibratory motion of the trade wind zones, and, with their belts of calms "and their limits for every month of the year, has been determined: the "course, bifurcations, limits, and other phenomena of the great Gulf stream, "have been more accurately defined; and the existence of almost equally "remarkable systems of currents in the Indian Ocean, on the coast of China, "and on the north-western coast of America, and elsewhere, has been "ascertained: there are, in fact, very few departments of the science of "meteorology and hydrography which have not received very valuable "additions; whilst the most accurate determination of the parts of the "Pacific Ocean (which are very limited in extent) where the sperm whale is "found, as well as the limits of the range of those of other species, has "contributed very materially to the success of the American whale fishery, "one of the most extensive and productive of all the fields of enterprize and "industry."

But when it is considered that, even for spaces so large as 5° of latitude and 5° of longitude, the least number of observations which are required for the three great oceans amounts to the enormous number of 1,669,200, the minimum number for each square being 100,—and when it is borne in mind that certain parts of the ocean are more frequently traversed by the vessels of one nation than by those of another, and some parts very rarely traversed by any, it will be evident that this admirable system of investigation, so ably begun by Lieut. Maury, can only be carried out effectually by the co-operation of all the principal commercial nations, and for this purpose the conference at Brussels was assembled.

A form of log, to embrace all the observations required, was agreed upon at the conference, as well as the hours at which the observations should be made and the mode of making them. The form of log contains the columns for the latitude and longitude of the vessel, by observation and by dead reckoning; for the direction and rate of the current; for the observed magnetic variation; for the direction and rate of the wind; for the height of the barometer; the temperature of the air and of evaporation; for the forms and direction of the clouds; the hours of fog, rain, snow, or hail; the state of the sea, and the temperature and specific gravity of the water at the surface and at certain depths; with occasional observations with thermometers having white, black, and sea-green bulbs.

The great importance of using no instruments but such as have been previously compared with standard instruments is strongly insisted on,* and a mutual interchange of sets of the instruments to be used by each nation recommended.

" The conference having brought to a close its labours, with respect to the " facts to be collected and the means to be employed for that purpose, has " now only to express a hope, that whatever observations may be made will be " turned to useful account when received, and not be suffered to lie dormant for " the want of a department to discuss them." (See Report of the conference.)

This recommendation has been wisely and most liberally responded to by our Government; and Captain Fitzroy, of the Royal Navy, so well known for his scientific ability and labours, has been appointed to take charge of a department, expressly formed for this purpose, under the Board of Trade.† The Governments of the Netherlands, Norway, and Sweden, Belgium and Portugal, have also appointed officers to carry out the recommendations of the conference;

* The American Government has already ordered 1,000 thermometers to be made and compared under the direction of the officers of the Kew Observatory.

† The admirable, and from the nature of the subject in such a place, most remarkable speech of Lord Wrottesley in the House of Lords, on the 26th April 1853, contributed greatly to the success of this measure.

and thus we may hope to see, "at length, every part of the ocean brought "within the domain of philosophic research, and a system of investigation "spread as a net over its surface, and it become rich in its benefits to "commerce, navigation, and science, and productive of good to mankind." (See Report.)

The establishment of this system of co-operative investigation amongst nations marks a great epoch in the history of science; but, to reap its full benefits, co-operation amongst the meteorologists on land is also absolutely necessary, and the most eminent amongst them in Europe and America, both North and South, have already expressed a desire for a second conference, to arrange the details of such a system; and there is every ground for hope, that before long we shall see it held, and arrangements made for mutual interchanges of the results obtained from the observations taken in all parts of the world. We shall then establish a system,—to use the words of Sir Thomas Brisbane, —by which "the science of meteorology will be more advanced in a few "years than it has hitherto been in centuries;" for, as Lieutenant Maury very justly observes, "the importance of concert among meteorologists all over the "world, and of co-operation between the observer on shore and the navigator "at sea, so that any meteorological phenomenon may be traced throughout "its cycle both by sea and land, is too obvious for illustration,—too palpable "to be made plainer by argument; and therefore the proposition for a "general conference to arrange the details of such a comprehensive system "of observation addresses itself to every friend of science and lover of "the useful in all countries." (See Lieut. Maury's Sailing Directions, 5th edition, p. 30.)

III. BALLOON ASCENTS.

An account of the meteorological observations made during Mr. Welsh's four balloon ascents, is published in the Philosophical Transactions for 1853.

The ascents were made in 1852, from Vauxhall, in Mr. Green's "Royal "Nassau Balloon," on the dates subjoined:

Date of Ascents.	Commenced at	Greatest Height reached at	Returned to the Ground at
	h. m.	h. m.	h. m.
1st. On the 17th August - - -	3.49	4.46	5.20
2d. On the 26th August - - - -	4.43	7.0	7.35
3d. On the 21st October - - -	2.45	3.29	4.20
4th. On the 10th November - - -	2.21	3.16	3.45

During the last ascent, the balloon was carried at the rate of 50 miles an hour over the ground between Greenwich and Folkestone.

The observed temperatures, at the surface and at the greatest elevation reached, were as follows :—

Ascents.	Temperature at Surface.	Temperature fell to 32° at	Greatest Elevation reached.	
			Feet.	Temperature.
1st - -	71° 7	13,200 feet	19,510	9°
2d - -	69 0	11,900 ,,	19,100	15
3d - -	59 0	10,500 ,,	12,640	27
4th - -	50 0	8,200 ,,	22,930	9

The decrease of temperature with the altitude appears to have been very uniform in each ascent up to the stratum of clouds, in passing through which the temperature remained nearly constant. Above the clouds, the decrease of temperature is again very regular, though the rate in each case varied.

The following table shows the height in feet both above and below the clouds, and including the whole series at which a decrease of 1° in the temperature took place :—

Ascents.	Below.	Above.	Whole Series.
1st - -	277·9	296·5	322·9
2d - -	281·8	298·1	382·0
3d - -	279·3	296·2	436·5
4th - -	266·0	328·3	400·6
Mean - -	276·	305·0	385·5

The region occupied by the clouds (in passing through which the temperature was nearly constant) varied in depth from 2500 ft. to 5000 ft., at altitudes varying from 2000 ft. to 7000 ft. from the surface, but light clouds were observed at all altitudes, and even at a great height above the highest point reached.

The decrease of temperature with altitude is usually assumed to be one degree in 100 yards, and if there are no clouds, this is a good approximation to the truth.

The most important results obtained from these observations are those which bear upon the theories relative to the diffusion of the aqueous vapour in the atmosphere. Meteorologists in general have assumed that the vapour diffuses itself through the dry air, as if it were a vacuum, and that the vapour con-

sequently exerts a pressure independent of that of the air, and depending solely upon its quantity. This pressure, called the elastic force, or tension of vapour, has been consequently assumed to diminish with the altitude; but the observations made by Mr. Welsh seem to destroy this assumption, and to establish the truth of the remark of the great La Place, that "Les vapeurs "aqueuses repandues dans l'atmosphère étant moins denses que l'air à la même "temperature, elles diminuent la densité de l'atmosphère," and to have the effect of diminishing the pressure of the atmosphere instead of increasing it.

In the ascent of the 21st October, the tension of vapour at the elevation of 800 ft. was observed to be *greater* than it was on the ground, and at the height of 3000 ft. the tension was very much greater still. In the ascent of the 17th August, the tension at 8500 ft. was greater than at 6000 ft. On the 10th of November, the tension was greater at an elevation of 8400 ft. than at 6000 ft.; it was also greater at 4000 ft. than at 2000 ft. Simultaneous observations on mountains, and at their foot, have given corresponding results.

These facts are quite irreconcileable with the theory before alluded to.

Professor Patton, in a communication to the Bombay Geographical Society, Vol. x., 1851, observes—"The incorrectness of the present mode of ascertaining the weight of dry air in the atmosphere may be established in two ways; either by shewing that the foundation of the theory is false, or that the results are inconsistent with the known state of the atmosphere.

"1st. The theory that has long held sway among chemists and natural philosophers, that one gas is a vacuum to all others, and that consequently the elastic force of a mixture of gases is the sum of the elastic force of the separate gases, is the necessary basis of the whole. It is unnecessary to multiply authorities on this point, for it is entwined with the whole modern system of meteorology. Mr. Glaisher, of the Royal Observatory, has stated it very distinctly. 'As in an atmosphere of pure steam the force of it at 'the earth's surface would be its weight, so in a mixture of atmospheres the 'elastic force of each at the earth's surface is the weight of the whole 'atmosphere of each kind; therefore, the elastic force of vapour representing 'the weight of the entire mass of aqueous vapour diffused throughout the 'atmosphere expresses the pressure on the surface in the cistern of the 'barometer, produced by the vapour present in the air at the time of 'observation, and it therefore becomes a correction to be applied sub-'tractively to all readings of the barometer, to obtain from them the pressure 'of the atmosphere of dry air.' Both of these principles we question: that the elastic force of the separate components at the earth's surface is the weight of the atmosphere of each kind, and that the pressure of vapour becomes a correction to be applied subtractively to obtain the pressure of dry air. Now a very simple experiment will show this. Place a glass jar over a candle

standing on a table, and depress the jar until it is within about a tenth of an inch from the table on which the candle is standing; in less than a minute the candle will be extinguished. Now this can only be explained by supposing that the gases within the jar prevent the ingress of the oxygen to take the place of that which has been consumed by the light. If the nitrogen within were a vacuum to the oxygen, there is sufficient place for it to enter. The one gas, therefore, does act upon the other. The same thing is seen in many chemical experiments, where one gas, such as chlorine, being put into a vessel, drives the other out. If, then, one gas presses on another, and, when intermixed, removes it from its original position, there is no reason whatever for supposing that the same does not take place between air and vapour. It is unnecessary here to enter more at length on this subject, which is more properly a question of natural philosophy; my object is simply to direct attention to its bearing on meteorology. If the oxygen and nitrogen of the air can act upon its vapour, it is no longer true that the elastic force of the vapour at the surface is the weight of the superincumbent vapour, and consequently it would give a very false idea of the quantity of dry air to subtract the tension of vapour from the height of the barometer, in order to find the weight of the dry air.

"2nd. But the incorrectness of this mode of correcting the barometer for pressure of moisture will be, perhaps, more clearly established by showing that the quantity of vapour required to produce the tension at the surface cannot exist in the atmosphere. The data required are, the tension and weight in a cubic foot of air, of vapour at various temperatures, and also the temperature of the air at various heights above the surface of the earth. The first two are very well known, and may be found in various authors, easily accessible; in the Greenwich Meteorological Observations for 1847, in the Bombay Observations for the same year, in Glashier's Tables, and in the Manual of Physical Research, now being prepared by my colleague. The law of the decrease of temperature according to the height above the surface is yet unknown; but a sufficient number of experiments have been made for our present purpose. The limit of perpetual snow at the equator is less than 18,000 feet above the surface, and at the outer limit of the atmosphere the air must have the temperature of space, which M. Pouillet has proved to be lower than the point at which carbonic acid becomes a solid. If the temperature were accurately known at every point of a vertical line, it would be a simple question of arithmetic to find the total weight of vapour that would saturate each part, and this might then be compared with the tension at the lowest point, in order to discover whether the tension is produced wholly by the weight of the superincumbent vapour. I have made this calculation from the two following

series of observations, made by Humboldt in South America, and Gay Lussac at Paris.

Humboldt.		Gay Lussac.	
Height in Feet.	Temperature.	Height in Feet.	Temperature.
—	81°·5	—	87°·35
3,281	71 ·2	9,945	54 ·5
6,562	65 ·1	13,987	53 ·6
9,843	57 ·7	16,405	41 ·45
13,124	44 ·6	18,471	32 ·0
16,405	34 ·7	20,149	26 ·18
19,686	—	22,885	14 ·9

" In order to take the most unfavourable supposition to my own views, I assume that the air between any two points, of which the temperatures are known, is saturated with vapour of the temperature of the lower point. The calculation will stand thus :—

Temperature of Dew Point.	Grains in a Cubic Foot of Vapour.	Weight of Vapour between two Points of Observations.	Temperature of Dew Po'nt.	Grains in a Cubic Foot of Vapour.	Weight of Vapour between two Points of Observations.
	Gr.	Gr.		Gr.	Gr.
81°·5	11·27	36,977	87°·35	13·52	134,456
71°·2	8·25	27,068	54 ·5	4·94	19,967
65°·1	6·89	22,608	53 ·6	4·81	10,830
57°·7	5·36	17,586	41 ·45	3·22	6,632
44°·6	3·5	11,583	32 ·0	2·37	3,977
34°·7	2·58	8,475	26 ·18	1·94	5,308
—	—	6,234	—	—	—
	Total -	130,531		Total -	181,190

" It appears, therefore, that the total weight of a column of vapour of 19.686 feet in height, and base a square foot, would be 130,531 grains, if the dew point were 81°·35 at the base, and the whole column saturated. At this height the barometer would stand at about 13 inches, and consequently only 3-7ths of the atmosphere exists above that height. In the case of this vapour,

there must be a much smaller proportion of the whole above this height, because, unlike the air, it is condensed by cold. If one half be added to the above sum, the whole weight of vapour that can exist will be equal to 195,798 grains. But this weight of 195,798 grains is only equal to a column of mercury of ·395 of an inch; because a column of mercury, of the same base and one inch high, is 495,833 grains. When the temperatures are assumed, the same as in M. Gay Lussac's experiment, the total weight of a column 22,885 feet in height is 181,190 grains; when the temperature of the dew point at the base is 87°·35, if one half be added to this for the vapour above this height, the total weight will be 271,195 grains, or equal to ·518 of an inch of mercury.

"In the former case the total weight is only equal to the tension of vapour at the temperature of 53°, although the air was assumed to be saturated at the temperature of 81°·5; and in the latter the weight is only equal to the tension of vapour at the temperature of 62°, the actual temperature being 87°·35.

"In the Bombay observations, which we have just received, there is frequently a pressure of moisture above an inch; and we have seen that the weight of all the vapour that can exist in a vertical column, when the temperature of the lowest point is 87°·35, would only produce a pressure of moisture equal to ·588 of an inch."

IV. ATMOSPHERIC WAVES.

That great waves traverse the atmosphere in various directions, is a fact which has long been recognized by meteorologists; and they have been made the subject of several very interesting essays and reports by Howard, Sir W. Herschel, Kreil, Birt, Sabine, and others; and by M. Quetelet, in his admirable work on the Climate of Belgium; and by Professor James Espy, in his Report on the Meteorology of the United States.

The extent, the course, and the velocity with which these great waves progress, have been traced by selecting the well-defined *maxima* and *minima* of the barometric curves, and by drawing lines through the stations at which these *maxima* and *minima* were simultaneously observed.

From the observations made at the Ordnance Survey Office, Phœnix Park, Dublin, the recurrence of a great symmetrical wave, in the month of November, in the years from 1829 to 1845 inclusive, has been recognized. Those of 1833, 1834, and 1838 commenced their passage on the 7th of November. The transit of the anterior trough of each was on that day of the apex of the wave on the 12th, 13th, and 14th; and the transit of the posterior trough in each case occurred on the 21st, making the time of passage in each case fourteen days.

Mr. Birt, in his Report on Atmospheric Waves to the British Association, in 1845, says, "In the case of a large wave stretching over an extensive area,
" the anterior and posterior trough would mark out parallel or nearly parallel
" lines of least pressure; the molecular movement would be strongest in those
" troughs, and directed towards them from each side: at stations removed
" from them the force of the wind would be greatly diminished, and at the
" intervening crest it would be so small as scarcely to be appreciable; but
" however small it might be upon the crest passing any station, the direction
" of the wind at that station would be reversed, and it would increase in
" intensity until the transit of the posterior trough." This important and very interesting fact was deduced by Colonel Sabine from the Toronto observations; and Professor Espy has shown that the increased pressure of the atmosphere, caused by the passage of a wave, is attended with a rise of temperature, and that the expansion of the atmosphere in the troughs produces a diminution of temperature; and thus the cause, which produces a frequent change of wind at the surface of the earth, and a change of temperature with those changes in the wind, is clearly traced to the passage of atmospheric waves in different directions. Mr. Birt, in his Report to the British Association, 1844, has given the transverse section of a wave, with the distance of 341 miles between the troughs.

In Plate I. I have represented the course of some atmospheric waves, in June 1841, which were traced by M. Quetelet across Europe and Asia, from Greenwich to Pekin, and I have represented, on the same plate, the maximum and minimum lines of atmospheric pressure, traced by Professor James Espy, in the United States, on the 28th of September, 1844, which passed to the N.E.*

I have also represented the central track of a rotatory storm, traced by Mr. Redfield, from the Cape de Verde Islands, through the West Indies, and again across the Atlantic to the north of the Orkneys. This storm occurred in August and September, 1853, and is taken from Sir W. Reid's work on the Progress and Development of the Law of Storms.

These rotatory storms have their origin on the confines of the tropical belt of calms, and are produced by the oblique passage of the trade winds into and along the region of calms, just as occasional small whirlpools are produced between the dead water and the current behind a rock in any stream; and just as these whirlpools revolve in opposite directions on either side the dead water, so the great storms revolve in opposite directions on either side of the belt of calms.

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* Espy's Report on Meteorology, 1850.

This rotatory motion, which commences in the lower regions of the atmosphere is soon propagated into the higher regions, and gradually coming under the influence of the general current of the atmosphere towards the N.E. and S.E., is gradually turned from its westerly direction along the belt of calms into a N.W. and S.W. direction, till it reaches the parallel of about 30°, when it is carried away in the great main N.E. and S.E. currents; and it is highly probable that the surging of atmospheric waves in different directions has its origin also in irregularities in the flow of the current of air from the region of calms towards the N. and S. and throughout their course, like those waves which are produced behind a rock in a stream, when there are abortive efforts to produce a vortex. This track of the storm of August and September, 1853, may be considered as typical of that of the North Atlantic rotatory storms; and we know that this is the course of some of the waves which traverse the lower latitudes towards the north and south.

The principal conclusions which M. Quetelet has derived from his observations are,

1st. The atmosphere is generally traversed by several systems of different waves. These waves interfere and produce for each locality a special degree of pressure.

2nd. In the midst of all these special movements, a predominant system of waves is developed, which remains nearly constant for the same climatal region.

3rd. The atmospheric waves both in Europe and Asia are propagated from the north to the south, but not always with the same velocity; they move more rapidly in the Asiatic system and in the system of central Europe, than in Russia or in the Oural mountains.

4th. The atmospheric waves appear to move with fewer obstacles over the surface of seas than in the interior of countries. In general, the asperities of the Globe, and particularly chains of mountains, diminish their velocity, and also modify their intensity.

5th. The inequality of velocity on the continent, on the one part, and in the neighbourhood of the sea, on the other, explains the inflections which, throughout its whole length, the line indicating the general progress of the wave suffers.

6th. The velocity with which the waves are propagated is very variable; it may be estimated at from six to ten French leagues per hour. It is something more in central Europe and less in Russia. Moreover, this velocity varies from one wave to another, and even varies in different parts of the same wave. In the Oural mountains it is sometimes reduced to less than two leagues an hour.

7th. The direction of the winds have no apparent connexion with the directions of the barometric waves. This important fact seems favourable to

the hypothesis that compensating currents move in the lower part of the atmosphere, and in opposite directions to those of the currents which come from the pole towards the equator.

Professor James P. Espy, in his Second Report on the Meteorology of the United States, 1850, has given the following "generalizations," as the result of the observations taken in that country upon the laws of great storms in winter. The observations taken throughout the United States have been laid down in the manner represented on the map, No. I. More than eleven hundred of these charts were formed by Professor Espy; one for each day, for more than three years.

1. The rain and snow storms, and even the moderate rains and snows, travel from the west towards the east, in the United States, during the months of November, December, January, February, and March, which are the only months to which these generalizations apply.

2. The storms are accompanied with a depression of the barometer near the central line of the storm.

3. This central line of minimum pressure is generally of great length from north to south, and moves side foremost towards the east.

4. This line is sometimes nearly straight, but generally curved, and most frequently with its convex side towards the east.

5. The velocity of this line is such that it travels from the Mississippi to the Connecticut river in about twenty-four hours, and from the Connecticut to St. John, Newfoundland, in nearly the same time, or about thirty-six miles an hour.

6. When the barometer falls suddenly in the western part of New England, it rises at the same time in the valley of the Mississippi, and also at St. John, Newfoundland.

7. In great storms, the wind, for several hundred miles on both sides of the line of minimum pressure, blows towards that line directly or obliquely.

8. The force of the wind is in proportion to the suddenness and greatness of the depression of the barometer.

9. In all great and sudden depressions of the barometer there is much rain or snow; and in all sudden great rains or snows, there is a great depression of the barometer near the centre of the storm.

10. Many storms are of great and unknown length from north to south, reaching beyond our observers on the Gulf of Mexico and on the Northern Lakes, while their east and west diameter is comparatively small. The storms, therefore, move side foremost.

11. Most storms commence in the "far west," beyond our most western observers, but some commence in the United States.

12. When a storm commences in the United States, the line of minimum pressure does not come from the "far west," but commences with the storm, and travels with it towards the east.

13. There is generally a lull of wind at the line of minimum pressure, and sometimes a calm.

14. When this line of minimum pressure passes an observer towards the east, the wind generally soon changes to the west, and the barometer begins to rise.

15. There is generally but little wind near the line of maximum pressure, and on each side of that line the winds are irregular, but tend outwards from that line.

16. The fluctuations of the barometer are generally greater in the northern than in the southern parts of the United States.

17. The fluctuations of the barometer are generally greater in the eastern than in the western parts of the United States.

18. In the northern parts of the United States, the wind generally, in great storms, sets in from the north of east, and terminates from the north of west.

19. In the southern parts of the United States, the wind generally sets in from the south of east, and terminates from the south of west.

20. During the passage of storms, the wind generally changes from the eastward to the westward by the south, especially in the southern parts of the United States.

21. The northern part of the storm generally travels more rapidly towards the east than the southern part.

22. During the high barometer, on the day preceding the storm, it is generally clear and mild in temperature, especially if very cold weather preceded.

23. The temperature generally falls suddenly on the passage of the centre of great storms; so that sometimes, when a storm is in the middle of the United States, the lowest temperature of the month will be in the west on the same day that the highest temperature is in the east.

Query.—Does the southern boundary of these winter storms reach the belt of high barometer in the northern border of the trade winds? and does the northern border of these storms reach into and beyond the belt of low barometer near the arctic circle?

Do these storms commence at the Rocky Mountains? and do they traverse the entire Atlantic with similar phenomena to those contained in the above generalizations? In what direction exactly do they move? Is it not towards a point of the compass a little south of east?

That the above twenty-three generalizations, with slight modifications, will be proved to be true laws of nature, by a more copious induction of facts, I have but little doubt; and my confidence is founded chiefly on the two following reasons:—

First. On the known uniformity of nature in the production of phenomena. From this uniformity it is highly probable, nay, almost certain, that if a certain set of phenomena are observed to accompany all the storms investigated, even if the number is few, these same phenomena will be found to accompany all storms; and such is the fact, so far as investigations have yet gone, as it relates to the fundamental generalizations given above.

Second. I ground my belief that these generalizations, with slight modifications, will be found to be true laws of nature; on the fact, that all the phenomena yet observed, connected with storms, are explained by the following

Theory.

When the air, in any locality, acquires a higher temperature or a higher dew point than that of surrounding regions, it is specifically lighter, and will ascend: in ascending, it comes under less pressure and expands; in expanding from diminished pressure, it grows colder about a degree and a quarter for every hundred yards of ascent; in cooling as low as the dew point (which it will do when it rises as many hundred yards as the dew point at the time is below the temperature of the air in degrees of Fahrenheit), it will begin to condense its vapour into cloud; in condensing its vapour into water or cloud, it will evolve its latent caloric; this evolution of latent caloric will prevent the air from cooling so fast in its further ascent, as it did in ascending below the base of the cloud now forming; the current of air, however, will continue to ascend, and grow colder about half as much as it would do if it had no vapour in it to condense; and when it has risen high enough to have condensed, by the cold of expansion from diminished pressure, one hundredth of its weight of vapour, it will be about forty-eight degrees less cold than it would have been if it had had no vapour to condense, nor latent caloric to give out; that is, it will be about forty-eight degrees warmer than the surrounding air at the same height; it will, therefore, (without making any allowance for the higher dew point of the ascending current,) be about one tenth lighter than the surrounding colder air, and of course it will continue to ascend to the top of the atmosphere, spreading out in all directions above as it ascends, overlapping the air in all the surrounding regions in the vicinity of the storm, and thus, by increasing the weight of the air around, cause the

barometer to rise on the outside of the storm, and fall still more under the storm cloud, by the outspreading of air above, thus leaving less ponderable matter near the centre of the upmoving column to press on the barometer below.

The barometer thus standing below the mean under the cloud in the central regions, and above the mean on the outside of the cloud, the air will blow on all sides from without, inwards, under the cloud. The air, on coming under the cloud, being subjected to less pressure, will ascend, and carry up the vapour it contains with it, and as it ascends will become colder by expansion from constantly diminishing pressure, and will begin to condense its vapour into cloud at the height indicated before, and thus the process of cloud-forming will go on.

Now, it is known that the upper current of air in the United States moves constantly, from a known cause, towards the eastward, probably a little to the south of east, and as the upmoving column containing the cloud is chiefly in this upper current of air, it follows that the storm cloud must move in the same direction; and over whatever region the storm cloud appears, to that region will the wind blow below: thus, the wind must set in with a storm from some eastern direction, and as the storm cloud passes on, the wind must change to some western direction, and blow from that quarter till the end of the storm. These are the elements of the theory of storms, which, with the numerical results, are demonstrated proximately in my work on the Philosophy of Storms."

V. ON THE GENERAL CIRCULATION OF THE ATMOSPHERE.

FROM LIEUTENANT MAURY'S* SAILING DIRECTIONS, 1854.

Several years ago, I commenced to gather from old sea journals such information as they might be found to contain, relative to the winds and currents of the sea, and to embody the information so obtained on a series of charts in such a manner as to show, by pictures, the prevailing direction of the winds and currents for every month, and in every part of the ocean.

Indeed, the plan of the undertaking was to address the eye, to collect the experience of every navigator, and to present the combined results of the whole in such a manner that each one might, with a glance, have the benefit of the experience of all who had preceded him in any of the frequented parts of the ocean.

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* The United States Astronomer at Washington.

This enterprise has been seconded both by the Government and individuals. American shipmasters, generally, have come into it with great zeal. They make the observations required on every voyage, and send them to me at Washington.

There are some thousand or more ships voluntarily co-operating with me, and, as it might be supposed, from such a number of active and intelligent observers, we are collecting materials of great value.

During the course of these investigations, many interesting facts have been developed, amounting, in some cases, to actual discoveries of great interest—such as, a new route, which shortens the sailing distance to the equator some fifteen or twenty per cent., and, of course, proportionately to all ports beyond; the existence in the North Atlantic of a regular monsoon, and in the North Pacific, near the west course, of a perpetual south-west trade-wind near the equator, a unique phenomenon; also the existence, near the same place, of a system of monsoons.

My present purpose, however, is not to speak of these discoveries, but rather to treat of the insight which these investigations, undertaken on such a large scale, afford as to the general system of atmospherical circulation over the earth.

They teach us to regard the atmosphere as a vast machine that is apparently tasked to its utmost; but as one that is always in order and never breaks down.

It is a sewer into which, with every breath, we cast vast quantities of dead animal matter. It is a laboratory, into which, when the light and heat enter, they act upon this dead matter, decompose it, and resolve it into gaseous substances, to be, by the action again of certain imponderable agents, condensed into plants and trees.

If it were not for this condensation, the air would become tainted; it would send its impurities back into the lungs, and, continually receiving back more dead matter in return, it would finally become unfit for the respiration of certain animals, and man would perish from the face of the earth.

We hunger; we take as food that which has been gathered from the vegetable kingdom, into the stomach; there we elaborate it, into flesh and blood. After it has coursed through the system and performed its office, it is again cast forth into the atmosphere, to be re-converted into more vegetables to serve as food for other animals. Doubtless the animal and vegetable kingdoms are in exact counterpoise, the one destroying and the other re-arranging and rendering fit for use again, this same dead matter.

In Infinite Wisdom the two kingdoms are so balanced, that there is not an insect too much on one side nor a green leaf too little on the other. The atmosphere affords that compensation by which the proper proportions of each are maintained.

These are only some of the operations that are carried on daily and hourly through the machinery of the atmosphere which we are breathing; how important and profitable, therefore, does the study of its laws become!

It is an engine which pumps our rivers up from the sea, and carries them through the clouds to their sources in the mountains. Air and water are the great agents of the Sun in distributing his heat over the surface of the globe, cooling this climate, and tempering that; and in this light, I propose to consider the winds and to allude to the currents of the sea.

Though the winds blow here from the four quarters, and sometimes with such violence as to fill the mind with emotions of terror, yet such winds, in comparison with the general system of atmospheric circulation, are but eddies to the main current. They have no more effect in deranging or disturbing that system of circulation, than the shower which they bring with them has in disturbing the course of the Gulf Stream and other great currents of the sea.

From the parallel of about 30° north and south, nearly to the equator, we have two zones of perpetual winds, viz., the zone of the north-east trades on this side, and of south-east on that. They blow perpetually, and are as steady and as constant as the currents of the Mississippi River, always moving in the same direction. As these two currents of air are constantly flowing from the poles towards the equator, we are safe in assuming that the air which they keep in motion must return by some channel to the place near the poles whence it came, in order to supply the trades. If this were not so, these winds would soon exhaust the polar regions of the atmosphere, and pile it up about the equator, and then cease to blow, for the want of air to make more wind of.

This return current, therefore, must be in the upper regions of the atmosphere, at least until it passes over those parallels between which the trade-winds are always blowing on the surface; the return current must also move in the direction opposite to the direction of that wind which it is intended to supply. These direct and counter-currents are also made to move in a sort of spiral or loxodromic curve, turning to the west as they go from the poles to the equator, and in the opposite direction as they move from the equator towards the poles.

This turning is caused by the rotation of the Earth on its axis.

The Earth, we know, moves from west to east. Now, if we imagine a particle of atmosphere at the north pole, where it is at rest, to be put in motion in a straight line towards the equator, we can easily see how this particle of air, coming from the pole where it did not partake of the diurnal motion of the Earth, would, in consequence of its *vis inertiæ*, find, as it travels south, the earth slipping under it as it were, and thus it would appear to be

coming from the north-east and going towards the south-west; in other words, it would be a N.E. wind.

On the other hand, we can perceive how a like particle of atmosphere that starts from the equator to take the place of the other at the pole, would, as it travels north, in consequence of its *vis inertiæ*, be going towards the east faster than the earth. It would, therefore, appear to be blowing from the south-west and going towards the north-east, and exactly in the opposite direction to the other. Writing south for north, the same takes place between the south pole and the equator.

Now this is the process which is actually going on in nature; and if we take the motions of these two particles as the type of the motion of all, we shall have an illustration of the great currents in the air, the equator being near one of the nodes, and there being two systems of currents—an upper and an under—between it and each pole.

Let us return now to our northern particle, and follow it in a round from the north pole to the equator and back again; supposing it, for the present, to turn back towards the pole after reaching the equator.

Setting off from the polar regions, this particle of air, for some reason which does not appear to have been satisfactorily explained by philosophers, travels in the upper regions of the atmosphere until it gets near the parallel of 30°. Here it meets, also in the clouds, the hypothetical particle that is going from the equator to take its place toward the pole.

About this parallel of 30°, then, these two particles meet, press against each other with the whole amount of their motive power, produce a calm and an accumulation of atmosphere sufficient to balance the pressure from the two winds north and south.

From under this bank of calms, two surface currents of wind are ejected; one towards the equator, as the north-east trades, the other towards the pole, as the south-west passage winds—supposing that we are now considering what takes place in the northern hemisphere only.

These winds come out at the lower surface of the calm region, and consequently, the place of the air borne away in this manner must be supplied, we may infer, by downward currents from the superincumbent air of the calm region.

Like the case of a vessel of water which has two streams from opposite directions running in at the top, and two of equal capacity discharging in opposite directions at the bottom, the motion of the water in the vessel would be downward; so is the motion of the air in this calm zone.

The barometer, in this calm region, is said, by Humboldt and others, to stand higher than it does either to the north or to the south of it; and this is another proof as to the banking up here of the atmosphere and pressure from its downward motion.

Following our imaginary particle of air from the north across this calm belt, we now feel it moving on the surface of the earth as the north-east trade-wind; and as such it continues till it arrives near the equator, where it meets a like hypothetical particle, which has blown as the south-east trade-wind.

Here, at this equatorial place of meeting, there is another conflict of winds, and another calm region; for a north-east and south-east wind cannot blow at the same time in the same place. The two particles have been put in motion by the same power; they meet with equal force; and, therefore, at their place of meeting, are stopped in their course. Here, therefore, there is a calm belt.

Warmed by the heat of the Sun, and pressed on each side by the whole force of the north-east and south-east trades, these two hypothetical particles, taken as the type of the whole, ascend. This operation is the reverse of that which took place at the other meeting near the parallel of 30°.

This imaginary particle now returns to the upper regions of the atmosphere again, and travels there, until it meets, near the calm belt of Cancer, its fellow particle from the north, where it ascends as before, and continues to flow towards the pole as a surface wind from south-west.

Entering the polar regions obliquely, it is pressed upon by similar currents coming from every meridian: here our imaginary particle approaches the higher parallels more and more obliquely, until it, with all the rest, is whirled about the pole in a continued circular gale; finally reaching the vortex, it is carried upwards to the regions of atmosphere above, whence it commences again its circuit to the south as an upper current.

Now the course we have imagined an atom of air to take is this (Plate III.):—an ascent at P, at the north pole; an efflux thence, as an upper current, until it meets G (also an upper current), over the calms of Cancer. Here there is supposed to be a descent, as shown by the arrows along the wavy lines which envelop the circle. This upper current from the pole now becomes the N.E. trade-wind, B, on the surface: it rises up at the equator, and returns thence—we will suppose for the present only—back towards the north pole, as G, until it reaches the calms of Cancer, where it descends and and is felt on the surface as H the S.W. passage-wind; and so the circuit is completed for the northern hemisphere.

The Bible frequently makes allusions to the laws of nature, their operation and effects. But such allusions are often so wrapped in the folds of the peculiar and graceful drapery with which its language is occasionally clothed, that the meaning, though peeping out from its thin covering all the while, yet lies, in some sense, concealed, until the lights and revelations of science are thrown upon it; then it bursts out and strikes us with the more force and beauty.

As our knowledge of nature and her laws has increased, so has our understanding of many passages in the Bible been improved.

The Bible called the Earth "the round world;" yet for ages it was a most damnable heresy for Christian men to say, the world is round; and finally, sailors circumnavigated the globe, proved the Bible to be right, and saved Christian men of science from the stake.

"Canst thou tell the sweet influences of the Pleiades?"

Astronomers of the present day, if they have not answered this question, have thrown so much light upon it as to show that if ever it be answered by man, he must consult the science of astronomy.

It has been recently all but proved, that the Earth and Sun, with their splendid retinue of comets, satellites, and planets, are all in motion around some point or centre of attraction, inconceivably remote, and that that point is in the direction of the star Alcyon, one of the Pleiades! Who but the astronomer, then, could tell their sweet "influences?"

And as for the general system of atmospherical circulation, which I have been so long endeavouring to describe, the Bible tells it all in a single sentence: "The wind goeth towards the south, and turneth about unto the "north; it whirleth about continually, and the wind returneth again "according to his circuits."—Eccles. i. 6.

A like operation takes place in the southern hemisphere. We now see the general course of the "wind in his circuits," as we see the general course of the water in a river. There be many abrading surfaces, irregularities, etc., which produce a thousand eddies to the main stream; yet, nevertheless, the general direction of the whole is not disturbed nor affected by those counter currents; so with the atmosphere and the variable winds which we find here in this latitude. We see, also, that there must be about the habitable parts of the earth *at least* three zones or nodes, in which calms and light airs are the prevalent condition of the air.

One of these zones is near the equator, where the north-east and south-east trade winds meet, and form what is called the belt of equatorial calms.

The other zones lie between those parallels where the "wind that goeth towards the south" meets that which "turneth about unto the north;" they are the calms of Cancer and Capricorn. (See Plate III.)

About each pole we have, or, according to the views I have been endeavouring to make plain, we ought to have, a perpetual whirl of the wind in the ascending nodes there. I have endeavoured to represent them by the direction of the curved arrows at the poles, P and P (Plate III). Here, then, are two more nodes—five in all.

The wind approaches the north pole by a series of spirals from the south-west. If we draw a circle about the north pole, on a common terrestrial

globe, and intersect it by spirals to represent the direction of the wind, we shall see that the wind enters all parts of this circle from the south-west; and consequently that a whirl ought to be created thereby, in which the ascending column of air revolves from right to left, or *against* the hands of a watch.

At the south pole the winds come from the north-west, and consequently there they revolve about it *with* the hands of a watch.

That this should be so will be obvious to any one who will look at the arrows on the polar sides of the calms of Cancer and Capricorn (Plate III). These arrows are intended to represent the prevailing direction of the wind at the surface of the earth, on the polar side of these calms.

It is a singular coincidence between these two facts thus deduced and other facts which have been observed, and which have been set forth by Redfield, Reid, Piddington, and others, viz., that all rotary storms in the northern hemisphere revolve as do the whirlwinds about the north pole, viz., from right to left, and that all circular gales in the southern hemisphere revolve in the opposite direction, as does the whirl about the south pole.

How can there be any connection between the rotary motion of the wind about the pole and the rotary motion of it in a gale caused here by local agents? So far we see how the atmosphere moves, but the atmosphere, like every other department in the economy of nature, has its offices to perform, and they are many. I have already alluded to some of them; but I only propose at this time to consider some of the meteorological agencies which in the grand design of creation have probably been assigued to this wonderful machine.

To distribute moisture over the surface of the Earth, and to temper the climate of different latitudes, it would seem are the two great offices assigned by their Creator to the ocean and the air.

When the north-east and south-east trades meet, and produce the equatorial calms of the Atlantic, the air by this time is heavily laden with moisture, for, in each hemisphere, it has travelled obliquely over a large space of the ocean. The two winds meet here with opposing forces so nicely balanced that they neutralize each other, and a calm is the consequence; and as one is pressing from the north and the other from the south, upon the belt of the atmosphere over this calm region, and each with the whole amount of force that sets it in motion, we ought to have in this calm region an upward motion of the atmosphere, the motive power of which is the sum of these two forces. Now if we had barometrical determinations accurately made in the region of these calms, we should probably obtain an expression, in horse-power, if you please, of the whole amount of force exerted by the Sun in keeping up this system of atmospherical circulation, for it is the heat of the

Sun, it is thought, which causes the winds to blow and the waters to flow, at least, it is supposed to be the chief source of their motive power.

The air of the equatorial calms being charged with moisture, and thus pressed upon by the trade winds north and south, has no room for escape but in the upward direction. It expands as it ascends, and becomes cooler; a portion of its vapour is thus condensed, and comes down in the shape of rain. Therefore it is, that under these calms we have a region of constant precipitation.

Old sailors tell us of such dead calms of long continuance here; of such heavy and constant rains, that they have scooped up fresh water from the surface of the sea.

The conditions to which this air is exposed here, under the equator, are probably not such as to cause it to precipitate all the moisture that it has taken up in its long sweep across the waters.

Let us see what becomes of the rest, for nature in her economy permits nothing to be taken away from the earth which is not to be restored to it again in some form, and at some time or other.

Consider the great rivers—the Amazon and the Mississippi, for example; we see them day after day, and year after year, discharging an immense volume of water into the ocean.

"All the rivers run into the sea, yet the sea is not full."—Eccles. i. 7.

Where do the waters so discharged go, and where do they come from?

They come from their sources, you will say. But whence are their sources supplied? For unless what the fountain sends forth be returned to it again, it will fail and be dry.

We see simply in the waters that are discharged by these rivers, the amount by which the precipitation exceeds the evaporation throughout the whole extent of valley drained by them; and by precipitation, I mean the total amount of water that falls from, or is deposited by the atmosphere, whether as dew, rain, hail, or snow.

The springs of these rivers are supplied from the rains of heaven, and these rains are formed of vapours which are taken up from the sea, that "it be not full," and carried up to the mountains through the air.

"Note the place whence the rivers come, thither they return again."

Behold now the waters of the Amazon, of the Mississippi, the St. Lawrence, and all the great rivers of America, Europe, and Asia, lifted up by the atmosphere, and flowing in invisible streams back through the air to their sources among the hills, and that through channels so regular, certain, and well defined, that the quantity thus conveyed one year with the other is nearly the same: for that is the quantity which we see running down to the ocean through these rivers; and the quantity discharged annually by each river is, as far as we can judge, nearly constant.

We now begin to see what a powerful machine is the atmosphere; and though it is apparently so capricious and wayward in its movements, here is evidence of order and arrangement which we must admit, and proof which we cannot deny, that it performs this mighty office with regularity and certainty, and is therefore as obedient to law as is the steam engine to the will of its builder.

It too is an engine. The South Seas themselves, in all their vast extent, are the boiler for it, and the northern hemisphere is its condenser.

The proportion between the land and the water in the nothern hemisphere is very different from the proportion between them and the southern. In the northern hemisphere, the land and water are nearly equally divided. In the southern there is several times more water than land. All the great rivers in the world are in the northern hemisphere, where there is less ocean to supply them. Whence then are their sources replenished? Those of the Amazon are supplied with rains from the equatorial calms and trade-winds of the Atlantic.

That river runs east, its branches come from the north and south; it is always the rainy season on one side or the other of it; consequently it is a river without periodic stages of a very marked character. It is always near its high-water mark. For one-half of the year its northern tributaries are flooded, and its southern for the other half. It discharges under the line, and as its tributaries come from both hemispheres, it cannot be said to belong exclusively to either. It is supplied with water from the Atlantic Ocean.

Taking the Amazon, therefore, out of the count, the Rio de la Plata is the only great river of the southern hemisphere.

There is no large river in New Holland. The South Sea Islands give rise to none, nor is there one worth naming in South Africa that we know of.

The great rivers of North America and North Africa, and all the rivers of Europe and Asia, lie wholly within the northern hemisphere. How is it then, considering that the evaporating surface lies mainly in the southern hemisphere—how is it, I say, that we should have the evaporation to take place in one hemisphere and the condensation in the other? The total amount of rain which falls in the northern hemisphere is much greater, meteorologists tell us, than that which falls in the southern. The annual amount of rain in the north temperate zone is half as much again as that of the south temperate.

How is it, then, that this vapour gets from the southern into the northern hemisphere, and comes with such regularity, that our rivers never go dry, and our springs fail not? It is because of the beautiful operations and the exquisite *compensation* of this grand machine—the atmosphere.

It is exquisitely and wonderfully counterpoised. Late in the fall, throughout the winter, and in early spring, the Sun is pouring his rays with the greatest intensity down upon the seas of the southern hemisphere, and this powerful engine which we are contemplating is pumping up the water there for our rivers with the greatest activity. At this time the mean temperature of the entire southern hemisphere is said to be about 10° higher than the northern.

The heat which this heavy evaporation absorbs becomes latent, and with the moisture is carried through the upper regions of the atmosphere, until it reaches our climates. Here the vapour is formed into clouds, condensed, and precipitated. The heat which held this water in the state of vapour is set free, it becomes sensible heat, and it is that which contributes so much to temper our winter climate. It clouds up in winter, turns warm, and we say we are going to have falling weather. That is because the process of condensation has already commenced, though no rain or snow may have fallen. Thus we feel this southern heat, that has been bottled away in the clouds of southern summer, and set free in the process of condensation in our northern winter.

While evaporation is going on with most activity in the southern hemisphere, precipitation is taking place to the greatest extent here; the fall spell, the winter rains, and the "long season in May," are familiar terms of wet weather to us all. These are the seasons at which we look for high water, and expect our "inland seas" to be in good navigable order.

The vapour comes through the upper regions of the atmosphere, and is probably condensed here not many days after it is taken up there. Suppose it to travel with the velocity of the trade-winds, at the computed rate of twenty miles the hour, it will only take it about twenty days to reach us from the middle of the southern hemisphere.

We cannot ascend into the upper regions of the atmosphere to see what is going on there; but we have such a train of well-established facts derived from observations here below, that reason, mounting on them, boldly soars aloft, and bids us confidently to assert knowledge of what is going on there.

When we see and feel, as in the trade-wind region we do see and feel day after day, the year around, the wind blowing as steadily from the poles towards the equator as the Mississippi runs down to the Gulf, we are forced to the conclusion that as much air—precisely as much—as we see coming from towards the poles, and going towards the equator, has to go from the equator back towards the poles. If this were not so there would be an exhaustion, and this wonderful engine that we are considering would break down, for there would finally be a vacuum about the poles, with a tremendous atmospherical accumulation about the equator.

Recurring to the illustration given just now, and considering both hemispheres, we shall see that the atmosphere, like the string of a musical instrument, has its nodes or points of rest. These nodes serve as escape-valves to the winds. In the equatorial calms, both the N.E. and the S.E. trades have run their course on the surface; they are going up to blow as upper currents; and therefore the motion of the air here in these calms, could it be seen and measured, would be upwards; and for the same reason, when the two upper currents meet in the region of the tropics the motion of the air is downwards; for after passing this node each upper current becomes a surface wind, and each is going whence the other came.*

Important operations are carried on, and purposes grand in the system of terrestrial economy are doubtless subserved by these atmospheric nodes.

This singular fact has been brought out by the investigations which we are conducting at the Observatory with regard to the winds. Our investigations in the Atlantic, for we have not carried them much farther, show us that the S.E. trade-wind region is much larger than the N.E.—I speak of its extent over the Atlantic Ocean only.

The S.E. trades are the fresher; they often push themselves up to 10° or 15° of north latitude, whereas the N.E. trade-wind seldom gets south of the equator.

Seeing that there is so much more room for evaporation in the southern than in the northern hemisphere, and that there is so much more precipitation on this than on the other side of the equator, we are led to one of two conjectures: First, that aqueous vapour in its invisible state can permeate the atmosphere; in other words, it can flow through the air in separate or independent currents of its own, like some of the gases. In this case, we must further conjecture the seat of some power unknown, which would always drive this vapour from the southern over into the northern hemisphere. We know of no such tendency in vapour, of no such permeability of atmosphere, and of no such force in nature; and in this age, therefore, men would scarcely receive such a conjecture as one having plausibility enough to command their respect.

Abandoning this, therefore, we are led to another conjecture, which is, that the motion of the air, the general system of circulation, is not exactly such as I have already described; but that the N.E. trade-winds, for instance, when

* If this interchange of atmosphere did not take place between the two hemispheres, how would a proper mixture of the air be preserved? In the north there is much more land, and many more plants and animals to corrupt the air, than in the south; and, unless the interchange did take place, there would be a reason to infer a difference as to atmospherical purity in the two hemispheres.

they reach the equatorial calms, instead of turning back towards the north, as I have supposed, keep on towards the south, and the S.E. trade-winds make their tour north. In this case, the course of the winds, as described by Solomon, would be, as represented by the arrows, along the wavy curves (Plate III.) A, B, C, D, to the south pole, thence up with the arrow P and around with the hands of a watch, and back as indicated by the arrows along E, F, G, and H. Of course, as the surface winds, H and D, approach the poles there must be a sloughing off, if I may be allowed the expression, of air from the surface winds, in consequence of their approaching the poles. For, as they near the poles, the parallels become smaller and smaller, and the surface current must either extend much higher up, and blow with greater rapidity, as it approaches the poles, or else a part of it must be sloughed off above, and so turned back before reaching the poles. The latter is probably the case.

If this plate and description fairly represent the course of the winds, we shall see that the S.E. trade-winds would enter the northern hemisphere, and bear into it all their moisture, except that which is precipitated in the region of equatorial calms.

The South Sea then, if this reasoning be good, supplies mainly the water for this engine, while the northern hemisphere condenses it; we should, therefore, have more rain in the northern hemisphere. The rivers tell us that we have, at least on land; the great watercourses of the globe, and half the fresh water in the world, are found on our side of the equator. This fact alone, is strongly corroborative of this hypothesis.

The rain gauge tells us also the same story. The yearly average of rain in the north temperature zone is, according to Johnston, 37 inches. He gives but 26 in the south temperate.

Moisture is never extracted from the air by subjecting it from a low to a higher temperature, but the reverse. Thus, all that air which comes loaded with moisture from the other hemisphere, and is borne into this with the S.E. trade-winds, travels in the upper regions of the atmosphere until it reaches the calms of Cancer; here it becomes the suface wind that prevails from the southward and westward. As it goes north it grows cooler, and the process of condensation commences.*

* The peculiar clouds of the trade-winds are formed between the two currents of air. They are probably formed of vapour condensed from the upper current, and evaporated as it descends, by the lower and dry current from the poles. It is the same phenomenon up there which is so often observed here below: when a cool and dry current of air meets a warm and wet one, an evolution of vapour or fog ensues.

We may now liken it to the wet sponge, and the decrease of temperature to the hand that squeezes that sponge. Finally, reaching the cold latitudes, all the moisture that a dew-point of zero, and even far below, can extract, is wrung from it; and this air then commences to "return according to his circuits" as dry atmosphere. And here we can quote Solomon again: "The north wind driveth away rain." This is a meteorological fact of high authority and great importance in the study of the circulation of the atmosphere.

This air that is returning from the north in the general channels of circulation, does not ordinarily come in contact with the surface of the water, but remains in the upper regions, isolated from all sources of vapour, except the upper clouds, until it descends in the calms of Cancer, and commences to blow the trades, as at B (Plate III.). Here it is as the dry sponge, taking up and evaporating fresh water from the sea with great avidity. This supposition is strengthened by the circumstance that the saltest part of the ocean is near the calm belts of Cancer and Capricorn. By the time these winds reach the equatorial calms they are saturated with moisture; thus loaded, they return to refresh the earth with rain, to cover the hills with snow, and to supply the fountains of our great rivers with water.

By reasoning in this manner, we are led to the conclusion that our rivers are supplied with their waters principally from the trade-wind regions; the northern rivers from the southern trades, and the southern rivers from the northern trade-winds.

Taking for our guide such faint glimmerings of light as we can catch from nature, and supposing these views to be correct, then the saltest portion of the sea should be in the trade-wind regions, where the water for all the rivers is evaporated, and there the saltest portions are found.

Dr. Ruschenberger, of the navy, on his late voyage to India, was kind enough to conduct a series of observations on the specific gravity of sea-water.

In about the parallel of 17° N. and S., towards the polar borders of the trade wind regions, he found the heaviest water. Though so warm, the water here was heavier than the cold water to the south of the Cape of Good Hope.

In summing up the evidence in favour of this view of the general system of atmospherical circulation, it remains to be shown how it is, if the view be correct, there should be smaller rivers, or less rains in the southern hemisphere.

The winds that are to blow as the N.E. trade-winds, returning from the polar regions, where the moisture has been compressed out of them, remain, as we have seen, dry winds until they cross the calm zone of Cancer, and are

felt on the surface as the N.E. trades. About two thirds of them only can there blow over the ocean. the rest blow over the land; over Asia, Africa, and North America, where there is but comparatively a small portion of evaporating surface exposed to their action.

The zone of the N.E. trades extends, on an average. from about 29°, north to 7° north. Now, if we examine the globe to see how much of this zone is land, and how much water, we shall find, commencing with China, and coming over Asia, the broad part of Africa, and so on, across the continent of America to the Pacific, land enough to fill up, as nearly as may be, just one third of it. The land, if thrown into one body between these parallels, would make a belt equal to 120°, of longitude.

Upon this supposition, then, two thirds only of the N.E. trade-winds are fully charged with moisture, and only two thirds of the amount of rain that falls in the northern hemisphere falls in the southern. This estimate, as to the quantity of rain in the two hemispheres, is one which is not capable of verification by any more than the rudest approximations; for the greater extent of S.E. trades on one side, and of high mountains on the other, must each of necessity. and independent of other agents, have its effects.

These calm and trade-wind regions, or belts, move up and down the earth annually, in latitude nearly a thousand miles. In July and August, the zone of equatorial calms is found between 7°, N. and 12°, N., sometimes higher; in March and April, between latitude 5°, S. and 2°, N.

With this fact, these points of view, and the trade-wind Chart before us, it is easy to perceive why it is that we have a rainy season in Oregon, a rainy and dry season in California, another at Panama, two at Bogota, none in Peru, and one in Chili.

In Oregon it rains every month, but more in the winter months.

The winter there is the summer of the southern hemisphere, when this steam-engine is working with the greatest pressure.

The vapour that is taken up by the S.E. trades is borne along over the region of N.E. trades to latitude 35° or 40° N., where it descends, and appears on the surface with the S.W. winds of those latitudes. Driving upon the highlands of the continent, this vapour is condensed and precipitated during this part of the year almost in constant showers.

In the winter, the calm belt of Cancer approaches the equator. This whole system of zones, viz., trades, calms, and westerly winds, follow the Sun; and they of our hemisphere are nearer the equator in the winter and spring months than at any other season.

The S.W. winds, backing down at this season to the south, reach as far down as the lower part of California.

In winter and spring the land in California is cooler than the sea air, and is quite cold enough to extract moisture from it. But in summer and autumn the land is the warmer, and cannot condense the vapors of water held by the air. So the same cause which made it rain in Oregon now makes it rain in California. As the Sun returns to the north, he brings the calm belt of Cancer, and the N.E. trades along with him; and now, at places where, six months before, the S.W. winds were the prevailing winds, the N.E. trades are found to blow. This is the case in the latitude of California. The prevailing winds then, instead of going from a warmer to a cooler climate, as before, are going the opposite way; consequently, they cannot, if they have the moisture in them to make rains of, precipitate it under such circumstances.

Panama is in the region of equatorial calms. This belt of calms, as may be seen by the Charts, travels during the year back and forth, over about 17°, of latitude, coming father north in the summer, where it tarries for several months, and then returns so as to reach its extreme southern latitude some time in March or April.

Where these calms are, it is always raining, and the Chart shows that they hang over the latitude of Panama from June to November; consequently, from June to November is the rainy season at Panama.

The rest of the year that place is in the region of the N.E. trades, which, before they arrive there, have to cross the mountains of the isthmus, on the cool tops of which they deposit their moisture, and leave Panama rainless and pleasant, until the Sun returns north with the belt of equatorial calms after him. They then push the belt of N.E. trades farther to the north, occupy a part of the winter zone, and refresh that part of the earth with summer rains.

This belt of calms moves over more than double of its breadth; and the entire motion from south to north is accomplished generally in two months, May and June.

Take the parallel of 4°, N. as an illustration. During these two months the entire belt of calms crosses this parallel, and then leaves it in the region of the S.E. trades. During these two months it was pouring down rain on that parallel; after the calm belt passes it the rains cease, and the people in that latitude have no more wet weather till the fall, when the belt of calms recrosses this parallel on its way to the south. By examining the "Trade Wind Chart," it may be seen what the latitudes are that have two rainy seasons, and that Bogata is within the bi-rainy latitudes.

The coast of Peru is within the region of perpetual S.E. trade-winds, though the Peruvian shores are on the verge of the great South Sea boiler, yet it never rains there. The reason is plain, and the Charts make it obvious.

The S.E. trade-winds in the Atlantic Ocean first strike the water on the coast of Africa; travelling to the N.W. they blow obliquely across the ocean until they reach the coast of Brazil; by this time they are heavily laden with vapour, which they continue to bear along across the continent, depositing it as they go, and supplying with it the sources of the Rio de la Plata and the southern tributaries of the Amazon.

Finally they reach the snow-capped Andes, and here is wrung from them the least particle of moisture that that very low temperature can extract.

Reaching the summit of the range, they now tumble down as cool and dry winds on the slopes beyond. Meeting with no evaporating surface and with no temperature *colder* than that to which they were subjected on the mountain-tops, they reach the ocean before they become charged with fresh vapour, and before, therefore, they have any which the Peruvian climate can extract. Thus, we see how the top of the Andes becomes the reservoir from which are supplied the rivers of Chili and Peru.

We see, moreover, that the Andes and all other mountains which run north and south have a dry and a rainy side, and that the prevailing winds of the latitude determine which is the rainy and which the dry side.

Thus, let us take the southern coast of Chili for illustration. In our summer time, when the Sun comes north, and drags after him his belts of perpetual winds and calms, that the part of the coast is left within the regions of the N.W. winds—the winds that are counter to the south-east trades—which, cooled by the winter temperature of the highlands of Chili, deposit their moisture copiously. During the rest of the year, the most of Chili is in the regions of the S.E. trades, and the same causes which operate in California to prevent rain there, operate in Chili, only the dry season in one place is the rainy season of the other.

Hence we see that the weather side of all such mountains as the Andes is the wet side, and the lee side the dry. We shall now be enabled to determine, if the views which I have been endeavouring to present be correct, what parts of the earth are subject to the greatest fall of rain. They should be on the slopes of those mountains which the trade winds first strike after having blown across the greatest tract of ocean. The more abrupt the elevation, as the land rises from the ocean the greater the amount of precipitation.

If, therefore, we commence at the parallel of about 30° N. in the Pacific, where the N.E. trade winds first strike that ocean, and trace them through their circuits till they first strike high mountains, we ought to find such a place of heavy rains.

Commencing at this parallel of 30°, therefore, in the North Pacific, and tracing thence the course of the N.E. trade winds, we shall find that

they blow thence, and reach the region of equatorial calms near the Caroline Islands. Here they rise up, but, instead of pursuing the same course in the upper stratum of winds through the southern hemisphere, they, in consequence of the rotation of the earth, are made to take a S.E. course. They keep in this upper stratum until they reach the calms of Capricorn, between the parallels of 30°, and 40°, after which they become the prevailing N.W. winds of the southern hemisphere, which correspond to the S.W. of the northern. Continuing on to the S.E. they are now the surface winds; they are going from warmer to cooler latitudes; they become as the wet sponge, and are abruptly intercepted by the Andes of Patagonia, whose cold summit compresses them, and with its low dew-point squeezes the water out of them. Captain King found the astonishing fall of water here of nearly 13 feet (151 inches) in 41 days; and Mr. Darwin reports that the sea water along this part of the South American coast is sometimes quite fresh.

We ought to expect a corresponding rainy region to be found to the north of Oregon; but there the mountains are not so high, the obstruction to the S.W. winds is not so abrupt, the highlands are farther from the coast, and the air which these winds carry in their circulation to that part of the coast, though it be as heavily charged with moisture as at Patagonia, has a greater extent of country over which to deposit its rain, and consequently the fall to the square inch will not be as great.*

In like manner we should be enabled to say in what part of the World the most equitable climates are to be found They are to be found in the equatorial calms, where the N.E. and S.E. trades meet fresh from the ocean, and keep the temperature uniform, under a canopy of perpetual clouds.

The mean annual fall of rain on the entire surface of the Earth is estimated at about five feet.

To evaporate water enough annually from the ocean to cover the Earth, on the average, five feet deep with rain; to transport it from one zone to another, and to precipitate it in the right places, at suitable times, and in the proportions due, is the office of the grand atmospherical machine. This water is evaporated principally from the torrid zone. Supposing it all to come thence, we shall have encircling the earth a belt of ocean 3,000 miles in breadth,

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* I have since, through the kindness of A. Holbrook, Esq., U. S. attorney for Oregon, received the *Oregon Spectator* of February 13, 1851, containing the Rev. G. H. Atkinson's Meteorological Table kept in Oregon city, during the month of January 1851. The quantity of rain and snow for that month is 13·63 inches, or about one-third the average quantity that falls here during the year.

Evaporation

from which this atmosphere evaporates a layer of water annually 16 feet in depth; and to hoist up as high as the clouds, and lower down again, all the water in a lake 16 feet deep and 3,000 miles broad and 24,000 miles long, is the yearly business of this invisible machinery. What a power-engine is the atmosphere !† We see light beginning to break upon us, for we now begin to perceive why it is that the proportions between the land and the water were made as we find them in nature. If there had been more water and less land we should have more rain, and *vice versa;* and then climates would have been different from what they now are; and the inhabitants, neither animal nor vegetable, would have been as they are.

And as they are, that wise Being, who, in His kind Providence so watches over and regards the things of this world, that He takes knowledge of the sparrow's fall and numbers the very hairs of our head, doubtless designed them to be.

In some parts of the earth the precipitation is greater than the evaporation; thus, the amount of water borne down by every river that runs into the sea may be considered as the excess of the precipitation over the evaporation that takes place in the valley drained by that river.

In other parts of the earth the evaporation and precipitation are exactly equal, as in those inland basins such as that in which the City of Mexico, Lake Titicaca, the Caspian Sea, etc., etc., are situated, which basins have no ocean drainage.

If more rain fell in the valley of the Caspian than is evaporated from it, that sea would finally get full and overflow the whole of that great basin. If less fell than is evaporated from it again, then that sea, in the course of time,

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† Since this paper was read, the transactions of the Bombay Geographical Society, from May 1849 to August 1850, Vol. IX., has been published. From it I derived valuable information in relation to this as well as many other subjects. In his Annual Report to the Society, Dr. Buist, the Secretary, states on the authority of Mr. Laidly, the evaporation at Calcutta to be "about 15 feet annually; that between the Cape and Calcutta averages in October and November nearly $\frac{3}{4}$ inch daily; betwixt 10° and 20° in the Bay of Bengal, it was found to exceed an inch daily. Supposing this to be double the average throughout the year, we should," continues the Doctor, "have 18 feet of evaporation annually," p. cv. If, in considering the direct observations upon the daily rate of evaporation in India, it be remembered that the seasons there are divided into wet and dry; that in the dry season evaporation in the Indian Ocean, because of its high temperature, and also of the high temperature and dry state of the wind, probably goes on more rapidly there than anywhere else in the world; if, moreover, we remember that the regular trade-wind regions proper, are for the most part rainless regions at sea; that evaporation is going on from them all the year round, we shall have reason to consider the estimate of 16 feet annually for the trade-wind surface of the ocean not too high. What a powerful engine, therefore, may not the atmosphere be considered!

would dry up, and plants and animals would all perish there for the want of water. In the sheets of water which we find distributed over that and every other inhabitable inland basin, we see reservoirs or evaporating surfaces just sufficient for the supply of that degree of moisture which is best adapted to the well-being of the plants and animals that people such basins.

In other parts of the earth still, we find places, as the Desert of Sahara, in which neither evaporation nor precipitation takes place, and in which we find neither plant nor animal.

In contemplating the system of terrestrial adaptations, these researches have taught me to regard the great deserts of the earth, as the astronomer does the counterpoises to his telescope; though they be mere dead weights, they are, nevertheless, necessary to make the balance complete, the adjustments of this machine perfect. These counterpoises give ease to the motions, stability to the performance, and accuracy to the workings of the instrument They are *compensations*.

Whenever I turn to contemplate the works of nature, I am struck with the admirable system of compensation, with the beauty and nicety, with which every department is poised by the others; things and principles are meted out in directions the most opposite, but in proportions so exactly balanced and nicely adjusted, that results the most harmonious are produced.

It is by the action of opposite and compensating forces that the Earth is kept in its orbit, and the Stars are held suspended in the azure vaults of Heaven; and these forces are so exquisitely adjusted, that at the end of a thousand years, the Earth, the Sun and Moon, and every Star, is found to return to its proper place at the proper moment.

Nay, philosophers tell us, when the little snow-drop, which in our garden walks we may now see raising its beautiful head to remind us that spring is at hand, was created, that the whole mass of the earth, from pole to pole, and from circumference to centre, must have been taken into account and weighed, in order that the proper degree of strength might be given to the fibres even of this little plant.

Botanists tell us, that the constitution of this plant is such as to require that, at a certain stage of its growth, the stalk should bend and the flower should bow its head, that an operation may take place, which is necessary, in order that the herb should produce seed after its kind; and that after this its vegetable health requires that it should lift its head again and stand erect. Now, if the mass of the Earth had been greater or less the force of gravity would have been different; in that case the strength of fibre in the snow-drop, as it is, would have been too much or too little; the plant could not bow or raise its head at the right time; fecundation could not take place, and its family would have become extinct with the first individual that was planted,

because its "seed" would not have been "in itself," and therefore it could not reproduce itself.

Now, if we see such perfect adaptation, such exquisite adjustment, in the case of one of the smallest flowers of the field, how much more may we not expect "compensation" in the atmosphere, upon the right adjustment and due performance of which depends not only the life of that plant, but the well-being of every individual that is found in the entire vegetable and animal kingdoms of the World.

When the east winds blow for a little while, they bring us air saturated with moisture from the Gulf Stream, and we complain of the sultry, oppressive, heavy atmosphere; the invalid grows worse, and the well man feels ill, because, when he takes this atmosphere into his lungs, it is already so charged with moisture that it cannot take up and carry off that which encumbers the lungs, and which nature has caused to be deposited there, that this atmosphere may take up and carry off. At other times the air is dry and hot; he feels that it is conveying off matter from the lungs too fast; he realizes the idea that it is consuming him, and he calls it parching.

Therefore, in considering the general laws of atmospherical circulation, in order to get at the clue to them, I have felt myself constrained to set out with the assumption that, if the atmosphere had had a greater or less capacity for moisture, or if the proportion of land and water had been different—if the Earth, air, and water had not been in exact counterpoise—the whole arrangement of the animal and vegetable kingdoms would have varied from its present state. But God chose to make those kingdoms what they are; for this purpose it was necessary, in His judgment, to establish the proportions between the land and the water, and the desert, just as they are, and to make the capacity of the air to circulate heat and moisture just what it is, and to have it to do all its work in obedience to law and in subservience to order. If the proportions of each were not adjusted according to the reciprocal capacities of air to perform the functions required by each, why should we be told that He "measured the waters in the hollow of His hand, and comprehended the dust in a measure, and weighed the mountains in scales and the hills in a balance?"

Why did He span the heavens, but that He might mete out the atmosphere in exact proportion to all the rest, and impart to it those properties and powers which it was necessary for it to have, in order that it might perform all those offices and duties for which He designed it? I have not the time, and if I had the time, I have not the heart so to abuse the patience of those who read, as I should do, by attempting to discuss at this time the currents of the ocean, and to tell of the beautiful discoveries to which our system of investigations has led us with regard to those great agents in the terrestrial economy.

Harmonious in their action, the air and sea are obedient to law and subject to order in all their movements. When we consult them in the performance of their offices, they teach us lessons concerning the wonders of the deep, the mysteries of the sky, the greatness and the wisdom and the goodness of the Creator. The investigations into the broad-spreading circle of phenomena connected with the winds of heaven, and the waves of the sea, are second to none for the good which they do and the profit which they give.

The astronomer sees the hand of God in the sky; but the right-minded mariner, who looks aloft as he ponders over these things, hears His voice in every wave of the sea that "claps his hands" and feels His presence in every breeze that blows.

VI. ABSTRACTS FROM METEOROLOGICAL OBSERVATIONS.

No.		Latitude.	Longitude.
		° ′ ″	° ′ ″
1	Edinburgh - - - - -	55 58 0 N.	3 8 0 W.
2	Guernsey - - - - - -	49 33 0 ,,	2 40 0 ,,
3	St. John's, Newfoundland - - -	47 35 0 ,,	52 42 0 ,,
4	Quebec - - - - - -	46 48 33 ,,	71 13 15 ,,
5	Halifax, Nova Scotia - - -	44 39 20 ,,	63 36 40 ,,
6	Corfu - - - - - -	39 37 0 ,,	19 56 0 E.
7	Gibraltar - - - - -	36 6 20 ,,	5 20 53 W.
8	Malta - - - - -	35 53 49 ,,	14 30 28 E.
9	St. George's, Bermuda - - -	32 22 57 ,,	64 40 0 W.
10	Nassau, Bahamas - - - -	25 4 0 ,,	77 22 0 ,,
11	Hong Kong, China - - -	22 16 20 ,,	114 9 46 E.
12	Up Park Camp, Jamaica - - -	17 59 54 ,,	76 56 30 W.
13	Barbadoes - - - - -	13 4 37 ,,	59 40 8 ,,
14	Colombo, Ceylon - - - -	6 56 6 ,,	79 49 48 E.
15	Mauritius - - - - -	20 9 56 S.	57 28 41 ,,
16	Freemantle, W. Australia - - -	32 15 0 ,,	116 30 0 ,,
17	Auckland - - - - -	36 50 5 ,,	174 50 40 ,,

EDINBURGH.

EDINBURGH.

Latitude 55° 58′ 0″ N. Longitude 3° 8′ 0″ W.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	29·765	29·928	29·756	30·020	29·834	29·716	29·883	29·891	29·598	29·950	30·017	29·605	29·830
	3.30 p.m.	29·751	29·910	29·746	29·997	29·817	29·699	29·871	29·878	29·575	29·963	30·006	29·580	29·816
Mean range of barometer (observed)		0·014	0·018	0·010	0·023	0·017	0·017	0·012	0·013	0·023	0·013	0·011	0·025	0·014
Mean temperature of the air for each month and for the year, at	9.30 a.m.	34·5	38·6	47·3	50·1	58·5	59·5	58·5	55·0	50·3	44·7	37·3	38·7	47·7
	3.30 p.m.	36·7	43·1	49·4	53·1	61·4	62·2	61·7	57·3	51·9	46·0	39·0	39·8	50·1
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	34·2	36·5	43·5	46·1	53·9	55·5	54·4	51·3	47·6	42·8	36·2	36·7	44·8
	3.30 p.m.	34·4	38·8	44·3	48·1	55·2	57·1	56·5	52·8	49·0	43·5	37·4	37·5	46·2
Mean humidity for each month and for the year, at	9.30 a.m.	0·806	0·840	0·743	0·769	0·771	0·796	0·791	0·802	0·854	0·876	0·863	0·837	0·812
	3.30 p.m.	0·796	0·760	0·698	0·737	0·728	0·756	0·747	0·763	0·829	0·840	0·846	0·818	0·776
Mean maximum temperature of the air		38·2	43·0	51·5	56·7	65·6	65·7	64·2	59·8	53·1	48·2	41·6	41·6	52·4
Mean minimum temperature of the air		30·3	33·3	40·6	42·7	51·6	53·5	52·2	48·4	44·6	39·1	33·2	33·0	41·8
Approximate mean temperature of the air		34·2	38·1	46·0	49·7	58·6	59·6	58·2	54·1	48·9	43·7	37·3	37·3	47·1
Mean maximum temperature in the sun		—								—			—	
Mean minimum temperature on the grass	—	—	—	—	—		—						—	
Mean maximum temperature of evaporation	—		—						—	—				
Mean minimum temperature of evaporation			—		—				—	—				
Quantity of rain in each month { on the ground		—	—				—	—	—		—	—		Total. —
{ 65ft. 10in. above the ground		1·03	0·46	0·50	0·57	5·50	2·67	3·42	1·92	2·93	0·76	1·41	19·5	40·70
Greatest quantity of rain in 24 hours		Date, 0·20 2	Date, 0·43 15	Date, 0·08 1	Date, 0·31 29	Date, 2·05 12	Date, 0·81 15	Date, 1·10 27	Date, 0·51 9	Date, 0·40 10	Date, 0·14 25	Date, 0·52 14	Date, 0·51 8	For the year, June 2·05 12

Wind.	Direction.	February No.	February Rain on	March No.	March Rain on	April No.	April Rain on	May No.	May Rain on	June No.	June Rain on	July No.	July Rain on	August No.	August Rain on	Sept. No.	Sept. Rain on	October No.	October Rain on	Nov. No.	Nov. Rain on	December No.	December Rain on	January No.	January Rain on	Total No.	Total Rain on
Direction at 9.30 a.m.	N.	7	2	5	2	–			–					2	2			3	1	1		1		1		20	7
	N.E.	5	2	4	1	1		2	2	1	1			1		4	3			1	1	5	3	1	1	25	11
	E.	5	4	4	4	3		21	10	4		1		1	1	3		3	2	2	1	2	1	2	1	51	21
	S.E.	2	1	3	0	3	2	4	2	8	3	2	2	2	–	2		4	1	1		1	1	1	1	39	16
	S.	2	1	4	1	1	1	2	1		–	5	3	1		6	1	7	5	10	5	5	2	8	3	51	26
	S.W.	1	–	4	–	3	2	1	–	3		9	6	6	3	6	3	7	3	1	1	10	1	7	1	61	23
	W.	4	1	3	1	18	9		–	12	8	12	5	10	6	6	1	5	1	5	3	2		8	3	85	44
	N.W.	2	1	4	1	1		1	1	2	2	2	1	8	2	3	2	2	2	6	2	2				33	11
Direction at 3.30 p.m.	N.	9		6		–				–				2				2		3		5		2		29	
	N.E.	1		4		2		–		–		–		1		3		1				2		2		16	
	E.	9		5		4		21		8		1		1		3		2		2		2		3		64	
	S.E.	1		2		2		1		5		3		3		3		6		2		7		4		39	
	S.	1		4		3		3		2		5		2		2		5		5		5		7		44	
	S.W.	1		3		5		–		3		9		4		12		5		6		7		9		64	
	W.	4		6		11		1		11		10		12		3		7		5		2		1		76	
	N.W.	2		1		–		2		1		3		6		4		3		7		1		3		33	

	—	February	Date.	March	Date.	April	Date.	May	Date.	June	Date.	July	Date.	August	Date.	Sept.	Date.	October	Date.	Nov.	Date.	December	Date.	January	Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·195	21	30·256	19	30·287	9	30·362	13	30·282	3	30·116	9	30·394	10	30·500	5	29·972	30	30·398	9		–			30·517	Dec. 9
	3.30 p.m.			–		–				–	–	–		–								30·517	9	30·179	26		
Minimum height of barometer (observed)	9.30 a.m.	29·222	26	29·501	2	–		–	–	29·200	29	29·098	15	28·987	27					29·584	19	29·584	11	–			April 1
	3.30 p.m.			–		28·707	1	29·566	8	–	–	–		–		28·852	25	29·095	21			–		28·960	7	28·707	
Extreme range of barometer (observed)	–	0·973	–	0·752	–	1·580	–	0·796	–	1·082		1·018	–	1·407	–	1·618		0·877		0·814		0·933		1·219		1·810	Range.
Maximum temperature of the air	–	45·0	1	52·0	30	60·5	19	69·5	27	75·5	24	71·5	13	70·0	8	66·0	12	58·0	7	56·0	3	53·0	2	53·0	31	75·5	June 24
Minimum temperature of the air	–	19·0	12	25·5	19	32·0	9	31·5	9	44·5	3	49·5	1	45·0	31	41·0	27	34·0	3	30·0	27	32·5	28	18·5	3	18·5	Jan. 3
Extreme range of temperature	–	26·0	–	26·5	–	28·5	–	38·0	–	31·0	–	22·0	–	25·0	–	25·0	–	24·0	–	26·0	–	20·5		34·5	–	57·0	Range.
	1853	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January.		1854.	

OBSERVATIONS taken by Corporal J. Downing, R.S. and M., under the direction of Captain Henry James, Royal Engineers.

Edinburgh.

Latitude 55° 58′ N. Longitude 3° 8′ W. Height above the sea, 130 feet.

Remarks.

1853 :—

February.—Much snow during the month.

May.—A heavy fall of snow took place on Sunday, the 8th, which lasted from 6 till 8 o'clock p.m. On the 16th the corncrake arrived.

June.—The amount of rain that has fallen this month is considerably above the average. On the 19th, one inch of rain fell in an hour and a half, commencing at 2 o'clock, p.m. The weather has been agreeable and calm. Thunder has been heard in the distance.

August.—A bright and well defined comet observed on the 23rd and 24th, between 9 and 10 o'clock p.m. Small pox becoming prevalent.

September.—An unusual amount of sickness this month. Cholera, hooping cough, fever, and measles prevalent. Several cases of cholera have proved fatal. Measles have also been more fatal among children than usual.

October.—Several cases of cholera in Edinburgh and Leith have proved fatal this month.

November.—Cholera, measles, and hooping cough still prevalent.

December.—Measles and small pox very prevalent and fatal this month. A heavy fall of snow took place upon the 27th, commencing in the morning, and continuing the greater part of the day. The depth of snow on the ground was 6 inches. The minimum thermometer, on the night of the above date, was 22°; wind from the north.

1854 :—

January.—A severe thunder storm, and frequent flashes of lightning took place on the 20th, lasting half-an-hour. Rain heavy during the storm.

GUERNSEY.

GUERNSEY.

Latitude 49° 33′ 0″ N. Longitude 2° 40′ 0″ W.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	29·697	29·949	29·947	29·901	29·943	29·984	29·977	30·043	29·704	30·086	29·900	29·812	29·912
	3.30 p.m.	29·668	29·903	29·931	29·861	29·952	29·968	29·967	30·025	29·667	30·076	29·867	29·798	29·890
Mean range of barometer (observed)	—	0·029	0·046	0·016	0·040	0·009	0·016	0·010	0·018	0·037	0·010	0·033	0·014	0·023
Mean temperature of the air for each month and for the year, at	9.30 a.m.	38·8	38·4	49·09	—	—	—	—	—	—		45·8	44·0	
	3.30 p.m.	39·1	35·2	49·9	—	—	—			—		42·4	44·5	—
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	36·2	36·2	46·8		—				—	—	43·2	42·6	—
	3.30 p.m.	35·9	32·8	47·2	—	—	—			—	—	40·2	43·2	
Mean humidity for each month and for the year, at	9.30 a.m.	0·811	0·853	0·854	—	—		—	—	—	—	0·824	0·910	—
	3.30 p.m.	0·799	0·822	0·835			—		—	—		0·795	0·904	—
Mean maximum temperature of the air	—	40·7	43·4	49·4	—	—	—	—	—		—	45·6	47·1	—
Mean minimum temperature of the air	—	34·8	36·8	43·9	45·8	52·0	54·7	55·8	53·5	51·1	45·5	37·3	40·0	45·9
Approximate mean temperature of the air	—	37·7	40·1	46·6	—				—		- -	41·4	43·5	—
Mean maximum temperature in the sun		—	—	—		—	—		—		—	—		—
Mean minimum temperature on the grass	—	33·3	37·2	44·5	47·9				—	—	39·5	35·8	38·5	—
Mean maximum temperature of evaporation		36·1	39·7	47·1	51·4	56·2	59·5	60·3	57·4	53·4	47·5	43·0	45·1	49·7
Mean minimum temperature of evaporation		33·1	35·8	42·7	45·8	51·1	54·0	54·6	51·8	49·6	43·5	35·9	39·1	44·7
Quantity of rain in each month: on the ground	—	2·34	1·77	2·83	1·12	2·71	2·00	3·49	3·94	4·12	2·17	1·75	3·47	Total. 31·74
25 feet above the ground		1·90	1·57	2·80	1·07	3·61	1·84	3·49	3·86	3·77	1·95	2·49	4·39	32·77
Greatest quantity of rain in 24 hours	—	Date. 0·53 4	Date. 0·31 7	Date. 0·92 25	Date. 0·31 3	Date. 0·10 26	Date. 0·48 22	Date. 1·28 26	Date. 0·80 2	Date. 0·43 5	Date. 0·48 26	Date. 0·47 7	Date. 0·69 4	Au. 1·28 26

Wind.	Direction	1853 - February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January		Total. 1854.	
Number of Days from each Point, and Number of Days on which there was Rain.		No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on
Direction at 9.30 a.m.	N.	9	5	3	1	3		3	1	1	–		–	4	2	5		1	1	5	3	3	1		–	37	14
	N.E.	4		7	4	1	-	10		5	1	1		8	–	5	1	1	1	3	1	5	1	3	1	53	10
	E.	5	4	3	1	1	-	1	–	-	–	1		2	–	2	1	2	2	10	2	7	5	1	1	35	16
	S.E.	5		9	2	3	1	2	–		-	1	1	1	1	1		3	3	6	2	9	2	3	3	43	15
	S.		–	–	–	1	1	-	–	2	1	5	2	2	2	3	3	6	2	3	1	2	1	8	3	32	16
	S.W.		–	5	4	5	3	3	2	7	3	10	5	3	1	4	3	7	3	2	1	1	1	4	1	51	27
	W.	1	1	2	1	9	5	7	3	8	4	12	4	9	3	5	1	3	3			2	1	10	10	68	36
	N.W.	4	3	2	2	7	–	5	–	7	5	1		2	2	5	4	7	7	1	-	2	2	2	2	45	27
Direction at 3.30 p.m.	N.	3		2		3		3		2		1		2		7		1		4		3		2		33	
	N.E.	4		7		–		6		4		–		6		5		1		–		6		1		40	
	E.	3		5		1		3		–				4		1		2		10		8		—		37	
	S.E.	4		1		1		2		—		1		1		1		1		6		5		3		32	
	S.	1		1		2		—		—		5		2		3		1		3				8		29	
	S.W.			2		1		—		3		5		2		1		5		1				4		24	
	W.	2		1		14		6		10		13		8		6		5				1		6		72	
	N.W.	7		5		4		5		6		1		2		2		4		2		4		2		44	
	—	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	-	Date.		Date.		Date.		Date.		Date.		Date.	-	Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·224	1	–		–	–	30·132	20	30·190	8		–	–		30·374	5	-		30·615	9	30·357	9	–			
	3.30 p.m.			30·280	19	30·118	9	–	–	–		30·611	1	30·278	6			30·172	3	–				30·661	26	30·661	Jan. 26
Minimum height of barometer (observed)	9.30 a.m.	28·862	9	–		–	–	–	–	29·662	20	29·363	14	29·361	26	29·427	25			–		–		28·887	4	28·862	Feb. 9
	3.30 p.m.			29·530	15	29·289	22	29·548	7	–	–							28·899	19	29·662	15	28·994	14	-			
Extreme range of barometer (observed)	-	1·362	–	0·750	–	1·129	–	0·584	–	0·528		1·251		0·917	-	0·947		1·273		0·953		1·363		1·777		1·802	
Maximum temperature of the air	-	46·5	26	54·0	13	53·0	12	–	–	–	–	–	–	–	–	–		-	-	-	-	52·3	15	52·0	21	–	Mar. 19
Minimum temperature of the air	-	29·5	12	28·5	19	38·0	27	38·0	8	47·0	20	50·5	3	52·5	29	49·5	24	45·0	3	40·5	28	29·0	30	32·0	1	28·5	
Extreme range of temperature	-	17·0	–	25·5	–	15·0	–	–	–	–	–	–	–	–	–	-	-	–	–	–	–	23·3		20·0	-	–	

OBSERVATIONS made by Mr. John R. Mills, Clerk of Works, under the direction of Lieutenant-Colonels Barry, Alexander, and Yule, R. E., Commanding Royal Engineers.

Guernsey

Latitude 49° 33′ N. Longitude 2° 40′ W. Height above the sea 248½ feet.

Remarks.

1853 :—

April.—On the 1st of this month a severe shock of an earthquake was felt, at 10.35 p.m., Greenwich time.

ST JOHN'S, NEWFOUNDLAND.

ST. JOHN'S, NEWFOUNDLAND.

Latitude 47° 35′ 0″ N. Longitude 52° 42′ 0″ W.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Mean for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for the month and for the year, at	9.30 a.m.	30·007	29·593	29·909	29·905	29·934	29·985	29·974	29·941	29·902	30·126	29·817	29·822	29·909
	3.30 p.m.	29·980	29·609	29·889	29·847	29·942	29·982	29·755	29·916	29·888	30·091	29·909	29·831	29·886
Mean range of barometer (observed)		0·027	0·016	0·020	0·058	0·008	0·003	0·219	0·025	0·014	0·035	0·092	0·009	0·023
Mean temperature of the air for each month and for the year, at	9.30 a.m.	33·7	29·8	38·0	54·3	58·7	68·0	58·4	56·8	49·4	34·5	32·4	20·0	44·5
	3.30 p.m.	34·8	30·3	39·7	54·6	61·0	71·0	60·1	57·7	50·6	36·2	32·2	22·4	45·8
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	32·0	30·2	34·8	51·1	51·6	63·0	55·9	53·5	46·5	32·7	31·6	19·7	41·88
	3.30 p.m.	33·3	31·0	35·2	52·3	54·0	64·1	56·0	53·6	47·9	34·6	31·4	21·9	42·94
Mean humidity for each month and for the year, at	9.30 a.m.	0·798	0·941	0·754	0·809	0·663	0·761	0·859	0·822	0·822	0·831	0·918	0·955	0·827
	3.30 p.m.	0·849	0·974	0·730	0·862	0·690	0·709	0·804	0·792	0·802	0·852	0·915	0·952	0·827
Mean maximum temperature of the air		—	—	—	—	—	—	69·3	61·0	54·8	42·0	—	29·8	—
Mean minimum temperature of the air		19·5	23·3	24·3	37·3	43·3	49·85	46·2	44·5	42·06	25·7	24·5	14·5	32·91
Approximate mean temperature of the air		—	—	—	—	—	64·42	57·7	52·7	48·43	33·8	—	22·1	—
Mean maximum temperature in the sun	—	—	—	—	—	—	—	83·8	68·6	—	—	—	—	—
Mean minimum temperature on the grass	—	16·5	22·3	17·4	—	—	—	36·9	27·6	32·6	23·4	24·2	10·5	—
Mean maximum temperature of evaporation		—	—	—	—	—		66·5	57·6	52·7	39·7	38·4	29·5	
Mean minimum temperature of evaporation	—	21·8	23·6	25·3	39·9	40·0	47·4	48·3	41·6	34·6	21·3			—
Quantity of rain in each month — on the ground		3·91	3·39	6·60	4·28	4·997	1·87	4·24	6·335	3·745	2·615	10·718	2·35	Total. 55·05
Quantity of rain in each month — 20 feet above the ground	—	—	0·80	5·58	4·63	6·721	2·29	5·55	6·97	5·110	2·409	—	—	40·06
Greatest quantity of rain in 24 hours	—	Date. 1·16, 9	Date. 1·10, 19	Date. 1·15, 6	Date. 2·09, 27	Date. [illegible] 0·30	Date. 0·69, 29	Date. 1·63, 2	Date. 1·65, 8	Date. 1·22, 29	Date. 0·86, 25	Date. 2·50, 30	Date. 1·20, 13	For the year Dec. 2·500, 30

Wind. Number of Days from each Point, and Number of Days on which there was Rain.

Direction at 9.30 a.m.

Direction.	Feb. No.	Feb. Rain on	Mar. No.	Mar. Rain on	Apr. No.	Apr. Rain on	May No.	May Rain on	June No.	June Rain on	July No.	July Rain on	Aug. No.	Aug. Rain on	Sept. No.	Sept. Rain on	Oct. No.	Oct. Rain on	Nov. No.	Nov. Rain on	Dec. No.	Dec. Rain on	Jan. No.	Jan. Rain on	Total No.	Total Rain on
N.	6	1	1		4	–		–	3	2	1	–	1	1	4	2		–	1	1	–		–		21	7
N.E.	–	–	2		1	1	1	1	1	1	1	1	3	2	3	3	–		–		3	3	2	–	17	12
E.	1		–		1	1			1	–		–	1	–	2	1	–			–	1	–	–		7	2
S.E.	10	3	4	1	2	1	–	–	2	2	–	–	7	2	6	3	5	1	2	1	2	1	1	–	41	15
S.			2	1	2	–	1	–	2	–		–	1		2	2	2	1	3	2	4	2	–	–	19	8
S.W.	5	3	10	1	10	3	14	6	12	2	16	3	4	2	2	1	10	7	7	–	9	3	5	2	104	37
W.	4	1	9	1	5	2	10	3	6	1	9	3	7	1	4	3	5	3	6	2	4	1	11	3	80	24
N.W.	2	–	3	2	5	1	5	3	3	2	4	2	7	3	7	4	8	3	11	8	8	4	12		75	32

Direction at 3.30 p.m.

Direction.	Feb. No.	Mar. No.	Apr. No.	May No.	June No.	July No.	Aug. No.	Sept. No.	Oct. No.	Nov. No.	Dec. No.	Jan. No.	Total No.
N.	8		1	—	4	1	1	2	–	—		–	17
N.E.	2		3	2	2	1	7	6		—	2	1	26
E.	—	—	2	1		2	—	2	1	—	–		8
S.E.	8	4	2	1	4	3	5	4	1	2	4	1	39
S.		2	3	—	2	2	3	1	4	1	1	1	20
S.W.	5	8	7	14	9	11	3	7	10	12	8	1	98
W.	3	11	8	6	4	5	7	2	4	4	4	22	83
N.W.	2	2	4	6	4	2	1	2	7	6	9	5	50

		February.	Date.	March.	Date.	April.	Date.	May.	Date.	June.	Date.	July.	Date.	August.	Date.	Sept.	Date.	October.	Date.	November.	Date.	December	Date.	January.	Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·588	2	30·634	12	30·261	17	30·283	11	30·323	1	30·203	11	30·321	7	30·330	10	30·385	27	30·806	13			30·559	30	30·806	Nov. 13
	3.30 p.m.		–									–				–	–			–		30·575	23	–	–		
Minimum height of barometer (observed)	9.30 a.m.	–										–				29·408	5			29·338	25	29·100	4	28·970	9		
	3.30 p.m.	29·236	18	28·736	19	29·188	1	29·162	2	29·325	21	29·666	1	29·325	23		–	29·286	4	–				–	-	28·736	Mar. 19
Extreme range of barometer (observed)	–	1·352		0·898		0·773		0·821		0·998		0·537	–	0·996		0·922	–	1·099		1·468	–	1·175		1·589		2·070	Range
Maximum temperature of the air		–	-					–	–				–	79·0	21	77·0	24	65·0	26	65·0	15	51·0	1	53·0	14	–	
Minimum temperature of the air	–	10·0	2	7·0	12	11·0	20	22·0	3	30·0	11	24·0	4	33·0	17	28·0	29	30·0	30	4·0	28	10·0	22	−6·0	26	−6·0	Jan. 26
Extreme range of temperature	–	–						–		–		–	–	46·0	-	49·0	–	35·0	–	61·0		41·0		59·0	-		
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		November.		December		January.		- 1854.	

OBSERVATIONS made by Lieutenant Jervois, R.E., under the direction of Major Robinson, R.E., Commanding Royal Engineers.

Newfoundland.

Latitude 47° 35′ N. Longitude 52° 42′ W. Height above the sea, 125 feet.

Remarks.

1853 :—

February.—Sickness and mortality from hooping cough and scarlatina considerably less than last month. This season is an unprecedented one for mildness and so little snow; such another has not occurred for many years.

March.—Scarlatina and hooping cough very much less prevalent than in former months. The buds of trees and shrubs swelling and showing return of vegetation.

May.—Vegetation springing rapidly; buds well matured. Scarlet fever becoming prevalent. The first iceberg seen off the harbour on the 6th.

October.—Typhus fever prevalent; 30 cases in one port, 80 miles from St. John's.

1854 :—

January.—Community, in general, healthy during this month.

QUEBEC.

QUEBEC.

Latitude 46° 48′ 33″ N. Longitude 71° 13′ 15″ W.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year at	9.30 a.m.		—	—	29·868	29·975	29·930	29·923	30·092	29·895	30·195	29·940	29·995	
	3.30 p.m.		—	—	29·800	29·878	29·908	29·887	29·947	29·865	29·707	29·887	29·946	—
Mean range of barometer (observed)		—	—	—	0·068	0·097	0·022	0·036	0·145	0·030	0·488	0·053	0·049	—
Mean temperature of the air for each month and for the year, at	9.30 a.m.	—	—	—	55·02	66·1	71·6	68·91	58·2	44·8	30·2	19·0	8·4	—
	3.30 p.m.		—	—	59·89	70·50	75·4	72·8	61·31	47·3	31·3	19·6	11·5	
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	—			49·77	59·2	63·95	62·8	54·0	42·4	28·9	18·8	8·7	—
	3.30 p.m.	—		—	51·35	61·8	64·72	64·84	55·9	43·7	29·9	19·4	11·7	—
Mean humidity for each month and for the year, at	9.30 a.m.		—	—	0·735	0·704	0·702	0·738	0·724	0·843	0·872	0·924	—	—
	3.30 p.m.		—	—	0·634	0·652	0·612	0·677	0·739	0·782	0·855	0·947		
Mean maximum temperature of the air		—	—	—	60·46	71·7	76·0	78·3	64·8	52·0	38·5	26·6	17·9	—
Mean minimum temperature of the air	—	—	—		44·0	54·1	58·0	57·87	47·0	36·0	22·4	12·6	0·5	
Approximate mean temperature of the air	—	—	—		52·08	62·9	67·0	68·08	55·9	44·0	30·4	19·6	9·2	—
Mean maximum temperature in the sun			—	—	60·1	82·43	89·56	87·5	79·3	62·3			—	
Mean minimum temperature on the grass		—	—	—	—	—	—		—		—	6·2	4·6	
Mean maximum temperature of evaporation		—	—	—	53·6	62·9	68·2	67·9	60·6	48·2	36·7	24·7	16·8	
Mean minimum temperature of evaporation	—	—	—	—	41·6	50·7	53·7	55·2	45·5	35·6	22·5	13·0	4·9	
Quantity of rain in each month — on the ground	—	—	—		4·91	4·745	4·98	7·06	2·94	6·19	2·57	0·00	0·00	Total.
Quantity of rain in each month — 25 feet above the ground					3·86	3·423	3·79	5·60	2·21	5·01	2·13	0·00	0·00	
Greatest quantity of rain in 24 hours		Date. —	Date. —	Date. —	1·01, Date 22	1·075, Date 7	1·52, Date 9	1·29, Date 7	0·61, Date 7	1·79, Date 25	0·89, Date 14	0·00, Date	0·00, Date	For the year. —

WIND.	Number of Days from each Point, and Number of Days on which there was Rain.																										Total.	
	Direction.	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on
Direction at 9.30 a.m.	N.	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–		1	–	1	–	–	–	–	–
	N.E.	–	–	–	–	–	–	2	–	3	–	3	1	5	3	2	2	2	2			4	–	3	–	–	–
	E.	–	–	–	–	–	–	7	3	5	3	–	–	6	2	9	2	1	–	13	5	7	–	7		–	–
	S.E.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	1	–	1	–			–	–
	S.	–	–	–	–	–	–	–	–	–	–	2	1	–	–	3	–	1	–	1	–			–	–	–	–
	S.W.	–	–	–	–	–	–	4	1	5	–	3	2	4	1	1	1	2	1			2		1	–	–	–
	W.	–	–	–	–	–	–	3	2	12	8	20	6	11	2	2	3	15	8	9	–	14		17		–	–
	N.W.	–	–	–	–			5	5	5	3	2	–	5	4	2	1	10	2	5	1	2	–	2	–	–	–
Direction at 3.30 p.m.	N.	–		–		–		–		–		2		–		2		–		1		–		1		–	
	N.E.	–		–		–		2		3		2		4		3		4		–		–		1		–	
	E.	–		–		–		5		6		2		5		8		1		10		10		6		–	
	S.E.	–		–		–		–		–		2		1		–		1		1		–		–		–	
	S.	–		–		–		1		1		1		1		–		–		2		–		–		–	
	S.W.	–		–		–		5		7		4		4		1		1		1		1		1		–	
	W.	–		–		–		4		13		14		12		14		16		12		16		19		–	
	N.W.	–		–		–		4		–		4		4		2		8		3		4		2		–	
	–	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	–	–	–	–	–	–	30·154	31	30·726	12	30·147	19	30·223	26	30·253	9	30·373	30	–	–	–	–	–	–	–	
	3.30 p.m.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			30·756	27	30·379	21	30·598	25	–	
Minimum height of barometer (observed)	9.30 a.m.	–	–	–	–	–	–	–	–	–	–	–	–	29·663	14	–	–	29·056	25	29·379	14	28·976	18	–	–	–	
	3.30 p.m.	–	–	–	–	–	–	29·194	30	29·657	7	29·673	4	–	–	29·690	24	–	–	–	–	–	–	29·257	13	–	
Extreme range of barometer (observed)	–	–	–	–	–	–	–	0·660	–	1·069	–	0·474	–	0·560	–	0·554	–	0·317	–	1·377	–	1·403	–	1·341	–	–	
Maximum temperature of the air	–	–	–	–	–	–	–	86·0	31	93·0	17	91·0	26	87·0	17	87·0	20	62·0	17	64·0	2	43·0	1	42·0	5	–	
Minimum temperature of the air	–	–	–	–	–	–	–	35·0	19	40·0	1	52·0	3	44·2	26	30·5	30	25·0	30	2·0	27	11·0	20	20·0	25	–	
Extreme range of temperature	–	–	–	–	–	–	–	51·0	–	53·0	–	39·0	–	42·8	–	56·5	–	37·0	–	62·0	–	32·0	–	62·0	–	–	
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January		1854.	

OBSERVATIONS made by Captain Beatson and Lieutenants Crease, Rankin, and Savage, R.E., under the direction of Lieutenant-Colonel Wulff, R.E., Commanding Royal Engineers.

Quebec.

Latitude 46° 48′ 33″ N. Longitude 71° 13′ 15″ W. Height above the sea, 230 feet.

Remarks.

1853:—

May.—No observations taken until the 11th. Town generally healthy. Scarlatina and measles prevalent among children. A severe storm on the afternoon of the 30th, during which a large ship was sunk opposite the city.

June.—Town healthy. Measles and scarlet fever the most prevalent diseases. A few deaths this month from sun's stroke. Humming birds arrived. Trees in full leaf.

July.—Measles and summer cholera prevalent. Hay harvest general towards the end of the month.

August.—Oppressive and disagreeably hot weather from the 1st to the 18th. Measles and summer cholera prevalent. Corn harvest begun towards the end of the month. A comet visible in the N.W., at 8 p.m., on the 20th.

September.—The aurora was very singular in appearance on the 2nd; at midnight it almost covered the sky. Disagreeably hot on the 19th. In consequence of the sudden change of temperature, a copious precipitation of vapour took place, causing a running down of water on walls and inside of all buildings, making every article damp.

October.—Measles and catarrh prevalent.

November.—Measles, catarrh, and rheumatism prevalent. Deciduous trees leafless. Falling stars numerous from the 4th to the 18th.

December.—Catarrh and rheumatism prevalent. Ground covered with snow.

1854:—

January.—Catarrh, lung diseases, and rheumatisms prevalent. Ground covered with snow, three feet deep.

HALIFAX, NOVA SCOTIA.

HALIFAX, NOVA SCOTIA.

Latitude 44° 39′ 26″ N. Longitude 63° 36′ 40″ W.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	30·014	29·742	29·967	30·011	30·061	30·043	29·994	29·977	29·959	30·288	29·945	30·065	30·007
	3.30 p.m.	29·713	29·689	29·949	29·979	30·013	29·978	30·016	30·008	29·971	30·168	29·839	29·995	29·944
Mean range of barometer (observed)	-	0·301	0·053	0·018	0·032	0·048	0·065	0·022	0·031	0·012	0·120	0·106	0·070	0·063
Mean temperature of the air for each month and for the year, at	9.30 a.m.	25·7	30·0	41·6	51·7	61·5	65·46	66·09	58·8	50·1	36·4	28·0	21·4	44·7
	3.30 p.m.	31·6	35·7	46·3	55·1	62·5	69·6	72·2	65·0	53·0	39·2	31·0	25·8	48·9
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	24·8	29·1	37·8	39·2	55·9	61·93	65·16	55·5	47·5	35·0	27·5	22·0	41·8
	3.30 p.m.	30·4	31·9	44·3	49·4	57·7	67·08	64·9	59·3	48·0	36·9	30·0	24·8	45·4
Mean humidity for each month and for the year, at	9.30 a.m.	0·806	0·719	0·736	0·791	0·758	0·783	0·797	0·867	0·773	0·890	0·925		
	3.30 p.m.	0·684	0·730	0·702	0·723	0·692	0·734	0·770	0·756	0·681	0·830	0·961	-	-
Mean maximum temperature of the air	---	32·9	37·5	47·5		68·1	73·6		—	—				
Mean minimum temperature of the air		19·6	25·7	31·0	—	-	55·9	59·06	48·4	33·1	26·0	18·8	6·5	-
Approximate mean temperature of the air	-	26·2	31·6	39·2		-	64·7			-			—	
Mean maximum temperature in the sun		—				82·6		85·56	83·0		52·6	39·5	31·0	
Mean minimum temperature on the grass		15·9		—			86·6	- -	—	—		20·5	10·6	
Mean maximum temperature of evaporation	-		—	42·1	51·0	61·1	67·16	65·2	62·0	50·3	44·9	32·4	31·8	-
Mean minimum temperature of evaporation.	—	18·7	21·7	28·9	32·5	46·73			44·2		—		—	
Quantity of rain in each month on the ground		3·86	4·01	5·37	4·686	1·860	3·85	5·69	5·07	4·16	5·59	8·14	2·72	Total. 55·306
Quantity of rain in each month 25 feet above ground		-	- -	3·84	3·865	1·355	1·88	5·03	4·42	4·28	4·68	7·25	2·99	-
Greatest quantity of rain in 24 hours		Date. 0·86 | 13	Date. 1·19 | 18	Date. 1·35 | 4	Date. 1·49 | 19	Date. 0·51 | 3	Date. 1·48 | 27	Date. 0·92 | 14	Date. 1·97 | 28	Date. 1·72 | 10	Date. 1·71 | 14	Date. 1·41 | 26	Date. 0·86 | 12	For the year Sept. 1·97 | 28

Wind.	Direction.	Feb. No.	Feb. Rain on	Mar. No.	Mar. Rain on	Apr. No.	Apr. Rain on	May No.	May Rain on	June No.	June Rain on	July No.	July Rain on	Aug. No.	Aug. Rain on	Sept. No.	Sept. Rain on	Oct. No.	Oct. Rain on	Nov. No.	Nov. Rain on	Dec. No.	Dec. Rain on	Jan. No.	Jan. Rain on	Total No.	Total Rain on
		Number of Days from each Point, and number of Days on which there was Rain.																								Total.	
Direction at 9.30 a.m.	N.	6	2	3	–	–	–	6	3	4	1	1	1	8	–	7	1	2	1	–	–	4	–	7	2		
	N.E.	2	1	2	1	3	2	–	–	3	1	2	–	3	1	1	1	2	1	–	–	7	1	5	1		
	E.	1	1	2	1	–	–	1	1	–	–	1	-	2	1	–	–	–	–	–	–	1	1				
	S.E.	1	1	3	2	3	1	6	5	–	–	3	2	4	3	2	2	–	–	–	–	1	1		–		
	S.	4	3	1	–	2	1	–	–	2	–	2	1	3	1	1	–	4	2	–		3	2	3	1	–	
	S.W.	6	3	4	1	7	1	13	–	11	6	8	6	5	3	8	4	11	5	–	–	5	1	5	2	–	
	W.	–	–	2	–	3	3	2	2	7	–	6	2	3	1	5	1	6	-	–	–	8	2	3	2		
	N.W.	8	1	14	1	12	–	3	–	3	–	6	1	3	–	5	–	6	–	–	–	2	2	8	–		
Direction at 3.30 p.m.	N.	3		5		1		4		3		1		3		6		3				5		3			
	N.E.	3		1		4		1		3		2				1		1				1		2			
	E.			1				–								–				–				4		–	
	S.E.	3		2		3		6		2		-		7		3				–		2		1			
	S.	4		1		2		2		3		4		6		1		4		–		1		3			
	S.W.	6		1		11		13		9		14		9		9		11		-		7		2			
	W.	1		5		2		2		7		6		3		5		6				8		8			
	N.W.	8		12		5		3		3		2		2		5		6				4		8			
			Date.		Date.		Date.		Date.		Date.		Date.		Date.		Date.		Date.		Date.		Date.		Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·636	2	30·657	11	30·589	12			30·361	12	30·300	29					30·314	30			30·155	22	30·720	30		
	3.30 p.m.		–	–				30·298	24					30·299	6	30·615	10	–		30·836	11					30·836	Nov. 11
Minimum height of barometer (observed)	9.30 a.m.	28·996	20	29·210	19	29·133	5	29·510	20									–		–		28·832	21	–		28·832	Dec. 21
	3.30 p.m.									29·378	9	29·719	2	29·510	19	29·558	29	29·296	6	29·261	11			29·228	11		
Extreme range of temperature		1·640		1·417		0·956		0·788		0·986		0·581		0·789	–	1·085		1·048		1·575		1·623		1·492		2·004	Range
Maximum temperature of the air	–	47·0	7	50·0	23	60·0	28	–		80·5	21			–		–	–	–	–	–		–		–			
Minimum temperature of the air		6·0	20	7·0	15	23·0	18	–			-	50·0	7	49·0	29	34·0	25		–	6·0	21	3·0	20	11·5	28		
Extreme range of temperature	–	41·0	-	43·0	–	37·0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January		1854.	

OBSERVATIONS made by Lieutenant Bland, R.E., under the direction of Lieutenant-Colonel Savage, R.E., Commanding Royal Engineers.

Halifax, Nova Scotia.

Latitude 44° 39′ 20″ N. Longitude 63° 36′ 40″ W. Height above the sea, 169 feet.

Remarks.

1853 :—

February.—A very beautiful and distinct solar halo appeared about 4.30 p.m., on the 28th, and continued till sunset; prismatic colours very clear, parhelion faint, but distinctly visible; the second circle about 75° above the horizon. This month has been mild and open. No snow on the ground.

March.—The weather has been unusually fine this month.

April.—On Saturday the 2nd, at 11.45 p.m., a tremor of the ground was felt, and a distinct rumbling noise heard in Halifax and (at least by report) nine miles round: presumed to have been a slight earthquake. Hooping cough and catarrh prevalent.

June.—Three storms of thunder and lightning this month; a rare thing in this country. One, which took place on the 26th, was accompanied with much vivid lightning, without corresponding thunder.

NOTE.—Many of the observations were omitted in February, March, April, and May, therefore the means for those months are not strictly correct.

CORFU.

CORFU.

Latitude 39° 37′ 0″ N. Longitude 19° 56′ 6′ E.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	29·734	—			29·935	29·974	30·002	29·915	30·091	29·984	29·924	30·058	
	3.30 p.m.	29·669		—		29·924	29·938	29·948	29·910	30·056	30·076	29·886	30·024	
Mean range of barometer (observed)	-	0·065		—		0·011	0·036	0·054	0·005	0·025	0·092	0·038	0·034	
Mean temperature of the air for each month and for the year, at	9.30 a.m.	55·4				75·5	81·56	80·4	77·6	71·2	63·0	56·6	51·2	
	3.30 p.m.	56·32				78·33	85·95	85·0	80·4	74·3	64·9	58·2	56·7	
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	51·45				74·23	72·5	73·4	70·0	64·3	57·3	53·1	51·0	
	3.30 p.m.	51·44				69·13	73·2	74·0	72·0	66·1	57·8	53·8	51·2	
Mean humidity for each month and for the year, at	9.30 a.m.	0·75				0·75	0·61	0·68	0·70	0·71	0·77	0·80	0·81	
	3.30 p.m.	0·74				0·68	0·57	0·57	0·63	0·66	0·73	0·75	0·75	
Mean maximum temperature of the air		56·5				79·9	88·9	85·7	83·7	76·3	67·4	60·9	59·2	
Mean minimum temperature of the air		49·4				66·7	72·0	71·5	69·4	63·7	55·6	52·7	49·4	
Approximate mean temperature of the air		52·8				73·3	80·45	78·6	76·1	70·0	61·5	56·8	54·3	
Mean maximum temperature in the sun		61·07				91·4	—		—					
Mean minimum temperature on the grass		47·1				61·4				—				
Mean maximum temperature of evaporation		54·9				67·9		76·5	74·9	68·4	60·6	56·5	54·8	
Mean minimum temperature of evaporation		45·5				60·8		65·6	64·6	59·3	51·9	49·2	46·3	—
														Total.
Quantity of rain in each month — on the ground		7·64		—		0·72	0·05	0·21	13·63	0·15	5·99	16·74	9·16	
Quantity of rain in each month — 24 feet above ground		5·73				0·58	0·04	0·17	8·75	0·12		12·15	6·39	
		Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	For the year.
Greatest quantity of rain in 24 hours		1·48 3	-	-	—	0·40 9	0·05 27	0·10 10	6·10 19	0·15 19	1·43 15	3·55 28	1·95 13	

Wind.	Number of Days from each Point, and Number of Days on which there was Rain.																									Total.	
	Direction.	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on
Direction at 9.30 a.m.	N.	1	1	–	–	–	–		–	3		13	1	6		8		6		3	2	4	3	8	3	–	–
	N.E.	1	–	–	–	–	–		–	2	–	1	–	5		5		3		7	1						–
	E.	2	1	–	–		–	–	–	5		7	–	10	2	6	2	4	–	5	2	9	5	7	3	–	–
	S.E.	5	4	–	–		–			13	2	3		3		4	4	7	–	6	2	9	7	4	3	–	–
	S.	6	3		–		–				–	–	–			1				–		2	2	3	2	–	–
	S.W.	6	6	–	–		–	–					–	–			–	–	–	2	2			1	1		–
	W.	2	2		–	–		–	–	1				1	1	1	1	2	1		–	2	2	1	1	–	
	N.W.	1	1	–		–	–	–		2	–	2		2		1	–	1		3	2	1	–	2	1	–	–
Direction at 3.30 p.m.	N.	2		–		–		–		5		9		11		7		3		4		2		4			
	N.E.	–		–		–		–		1		1		2		2		3		3		2		1		–	
	E.	2		–		–				2		1		1		2		2		3		5		6		–	
	S.E.	2		–		–		–		2		1		3		2		7		9		10		1		–	
	S.	9		–		–		–		1				–		2		6		2		3		3		–	
	S.W.	7		–				–		2		–				1		–		1		1		2			
	W.	1		–		–				2		3		3		1		2		2		3		1			
	N.W.			–		–		–		5		8		7		6		3		2		1		8			
	—		Date.	–	Date.	–	Date.	–	Date.		Date.		Date.	–	Date.		Date.		Date.		Date.	–	Date.	–	Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·157	28	–	–	–				–	–	30·134	8	–		30·093	1	30·265	15	30·332	7	30·139	7	30·443	26		
	3.30 p.m.	–	–		–	–				30·180	11			30·101	22				–						–	–	
Minimum height of barometer (observed)	9.30 a.m.	29·315	19						–	29·718	6				–	29·477	19	29·823	19	29·040	11			–		–	
	3.30 p.m.			–	–				–			29·736	12	29·752	10							29·571	16	29·461	13		
Extreme range of barometer (observed)	–	0·812	–	–	–					0·162		0·398		0·352		0·616		0·442	–	1·292		0·568		0·979			
Maximum temperature of the air	–	61·2	12	–	–	–	–	–		85·8	30	100·6	19	94·2	6	98·7	8	82·7	3	73·0	3	65·9	16	65·8	13	–	
Minimum temperature of the air	–	41·1	28	–	–	–	–	–		56·0	18	66·5	6	64·7	11	63·0	30	56·5	6	45·2	12	46·0	28	42·3	30	–	
Extreme range of temperature	–	20·1	–	–	–	–	–	–		29·8	–	34·1	–	29·5	–	35·7	–	26·2		27·8	–	19·9	–	23·5	–	–	
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January.		1854.	

OBSERVATIONS made by Captain Yorke, R.E., under the direction of Colonel Tylden, R.E., Commanding Royal Engineers.

Corfu.

Latitude 39° 37′ N. Longitude 19° 56′ E. Height above the sea 205 feet; from 1st March 74 feet.

Remarks.

1853 :—

February.—A smart shock of an earthquake on the 11th, at 11 a.m. A violent storm on the 18th, about half-past 11 p.m., from S.E., veering round to N.W., and blowing a hurricane, with heavy rain, for two hours. Great damage done to roofs, trees, and shipping. Another sharp shock of an earthquake, felt during a lull, at midnight, and a third (slighter) at 3 a.m., on the 19th.

June.—At commencement, flax pulled, and hay got in. On the 12th, wheat harvest begun. Figs in the market on the 15th.

November.—On the 27th, a severe shock of an earthquake, at 4. 7′ 1″ p.m.; a second on the 28th, at 4. a.m., and a third on the 29th, at 11.30 a.m.

December.—A slight shock of an earthquake on the 11th.

GIBRALTAR.

GIBRALTAR.

Latitude 36° 6′ 20″ N. Longitude 5° 20′ 53″ W.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	29·892	30·111	30·077	29·953	30·087	30·110	30·012	30·052	30·082	30·036	29·925	30·163	30·041
	3.30 p.m.	29·851	30·065	30·035	29·932	30·063	30·037	29·971	30·011	30·035	29·993	29·894	30·111	30·090
Mean range of barometer (observed) -	-	0·041	0·046	0·042	0·021	0·024	0·073	0·041	0·041	0·047	0·043	0·031	0·049	0·041
Mean temperature of the air for each month and for the year, at	9.30 a.m.	50·9	55·9	62·7	63·4	71·4	76·2	79·7	74·4	66·8	59·9	53·9	53·4	64·0
	3.30 p.m.	53·6	59·9	66·4	65·6	75·0	80·1	82·8	76·6	69·1	60·2	56·0	57·6	66·9
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	46·8	49·9	57·2	57·1	63·6	69·9	72·0	68·2	61·5	55·6	51·0	49·8	58·55
	3.30 p.m.	48·3	53·0	59·1	58·6	65·1	70·8	73·3	69·2	62·6	57·2	51·7	52·1	60·08
Mean humidity for each month and for the year, at	9.30 a.m.	0·756	0·716	0·739	0·738	0·688	0·740	0·701	0·749	0·762	0·777	0·832	0·789	0·849
	3.30 p.m.	0·716	0·661	0·688	0·695	0·622	0·645	0·644	0·706	0·724	0·751	0·763	0·720	0·695
Mean maximum temperature of the air -	—	-	—	—	—	—	—	85·7	80·2	72·1	65·1	59·7	60·5	
Mean minimum temperature of the air -		46·5	48·5	56·1	55·8	61·6	66·9	70·0	69·7	59·9	54·3	50·8	48·8	57·40
Approximate mean temperature of the air	—						—	77·85	74·95	66·15	59·70	55·25	54·65	
Mean maximum temperature in the sun -	-	—	—					—	-	—	—		—	
Mean minimum temperature on the grass	-	44·2	46·2	56·1	54·2	59·9	65·2	71·2				—	—	-
Mean maximum temperature of evaporation	-	-	—	—			-	74·5	72·2	66·6	62·6	56·0	55·8	
Mean minimum temperature of evaporation		42·9	41·9	52·9	52·6	57·6	63·5	65·9	63·5	57·0	51·9	48·5	45·8	53·91
Quantity of rain in each month - - - on the ground		10·49	2·51	1·32	6·48	0·07	·00	0·01	1·24	2·59	5·56	11·94	5·08	Total. 47·29
25 feet above the ground -		10·19	2·44	1·30	6·34	0·07	·00	0·01	1·23	2·55	5·45	11·73	4·94	46·25
Greatest quantity of rain in 24 hours -		Date, 2·75 22	Date, 1·04 30	Date, 0·63 19	Date, 1·50 25	Date, 0·03 4	Date ·00	Date, 0·01 10	Date, 0·92 2	Date, 1·72 28	Date, 1·28 17	Date, 2·50 14	Date, 1·40 1	For the year Feb. 2·75 22

Wind.	Direction.	February. No.	February. Rain on	March. No.	March. Rain on	April. No.	April. Rain on	May. No.	May. Rain on	June. No.	June. Rain on	July. No.	July. Rain on	August. No.	August. Rain on	Sept. No.	Sept. Rain on	October. No.	October. Rain on	Nov. No.	Nov. Rain on	December. No.	December. Rain on	January. No.	January. Rain on	Total. No.	Total. Rain on
		Number of Days from each Point, and Number of Days on which there was rain.																									
Direction at 9.30 a.m.	N.		–	2	–		–		–	2	–	1		1			–	2	2	3	2	2	3	4	1	17	8
	N.E.	1	1	1	1	1	–		–		–	3		2		2	–	1	1	3	1	1	–	1		16	1
	E.		–	–				–		–	–	1	–	1			–	1	1	1		–				4	1
	S.E.			2	–	3	–	2	2	2	–	10	–	6	–	8	2	9	5	7	4			4	1	53	11
	S.	1	1	3	1		–	1	1	–	–			1						3	3	4	4	2	2	15	12
	S.W.	4	3	7	3	8	1	17	11	15	3	5		10	1	6	1	1	2	3	1	7	6	9	5	95	37
	W.	3	2	1	–	2	1	4	1	–	–	2	–	1				1							–	11	4
	N.W.	19	10	15	7	16	1	10	3	11	1	9	–	9		11	1	13	7	10	3	17	8	11	5	154	47
Direction at 3.30 p.m.	N.	1		–		2		–		1		–		2		–		1		2		1		–		10	
	N.E.			–		–		–		–		2		2		2		1		1		1		2		11	
	E.	–		–		–		–		–		–		–		–		–		–		–				–	
	S.E.			–		2		–		2		8		5		8		3		7		1		5		41	
	S.	–		7		1		3		2		–		4		2		1		2		6		3		31	
	S.W.	3		11		11		18		17		8		10		8		11		5		6		3		111	
	W.	5		3		3		3		1		1		–		1		1				–		3		21	
	N.W.	19		10		11		7		7		12		8		9		13		13		16		15		140	
	–	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.		Date.	–	Date.		Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·215	1	30·398	4	30·321	5	30·213	18	30·240	26	30·214	3	30·138	14	30·297	29	30·249	21	30·281	24		–	30·632	27	30·632	Jan. 27
	3.30 p.m.	–		–		–		–	–	–	–	–					–	–		–		30·180	31	–			
Minimum height of barometer (observed)	9.30 a.m.	–		–	–	–		–	–	29·903	1	–	–									29·542	21				Jan. 3
	3.30 p.m.	29·537	9	29·708	21	29·647	13	29·599	23	–		29·912	1	29·885	12	29·831	13	29·830	13	29·550	17		–	29·361	3	29·361	
Extreme range of barometer (observed)	–	0·678	1	0·690	–	0·674	–	0·614	–	0·337	–	0·302	–	0·253		0·466	–	0·419		0·731		0·638		1·271		1·271	Range
Maximum temperature of the air	–	–	–	–	–	–	–	–	–	–	–	–	–	91·6	19	85·2	4	84·9	3	71·3	12	67·3	8	65·9	25	–	
Minimum temperature of the air	–	39·5	11	41·2	1	53·0	29	51·2	5	54·5	11	61·2	21	65·2	24	60·8	25	50·9	21	46·7	23	32·7	31	37·9	1	32·7	Dec. 31
Extreme range of temperature	–	–		–	–	–	–	–	–	–	–		–	26·4		24·4	–	34·0	–	24·6	–	34·6		28·0	–	–	
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January		1854.	

OBSERVATIONS made by Lieutenant Fisher, R.E., Sergeant Rowse, R.S.M., and J. V. Allen, C.W., under the directions of Colonels Jones and Rose, R.E., Commanding Royal Engineers.

Gibraltar.

Latitude 36° 6′ 20″ N. Longitude 5° 20′ 53″ W. Height above the sea 46 feet.

1853 :

No Remarks throughout the year.

MALTA.

MALTA.

Latitude 35° 53′ 49″ N. Longitude 14° 30′ 28″ E.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	29·763	29·920	30·001	29·952	29·984	30·052	30·023	29·953	30·065	29·987	29·893	29·987	29·965
	3.30 p.m.	29·717	29·905	29·879	29·942	29·956	30·038	29·998	29·924	30·030	29·960	29·886	29·899	29·927
Mean range of barometer (observed)	—	0·046	0·015	0·122	0·010	0·028	0·014	0·025	0·034	0·035	0·027	0·007	0·088	0·038
Mean temperature of the air for each month and for the year, at	9.30 a.m.	60·0	58·3	61·06	69·0	71·85	80·11	81·6	77·6	72·2	64·96	58·0	53·7	67·36
	3.30 p.m.	60·0	58·7	61·63	68·48	70·80	82·96	82·9	78·7	72·1	65·07	59·0	54·5	67·90
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	53·0	51·6	55·0	62·55	65·03	71·35	73·06	70·6	67·4	61·51	56·0	51·5	61·51
	3.30 p.m.	52·0	51·1	55·23	61·96	64·78	71·85	72·8	70·0	67·0	61·55	55·5	52·0	61·31
Mean humidity for each month and for the year, at	9.30 a.m.	0·653	0·671	0·694	0·725	0·719	0·632	0·672	0·713	0·793	0·895	0·785	0·819	73·0
	3.30 p.m.	0·627	0·631	0·6[illegible]7	0·720	0·739	0·595	0·626	0·666	0·780	0·831	0·770	0·793	70·5
Mean maximum temperature of the air	—	—	62·4	65·2	73·76	76·46	87·79	87·75	83·6	77·5	70·55	62·0	59·7	
Mean minimum temperature of the air	—	53·0	51·8	54·03	59·38	62·46	70·69	71·5	69·2	64·7	57·84	52·0	49·5	59·675
Approximate mean temperature of the air	—	–	57·1	59·61	66·57	69·46	79·24	79·6	76·33	71·1	64·19	57·0	54·6	—
Mean maximum temperature in the sun	—	—		—	—	—	—	–	—	—		—	–	–
Mean minimum temperature on the grass	—	46·0	44·0	49·63	57·46	61·06	65·93	68·68	63·9	64·3	55·39	45·5	48·5	55·86
Mean maximum temperature of evaporation	—	55·0	54·8	57·6	64·76	67·21	74·51	75·6	73·7	70·0	64·46	57·0	54·5	61·09
Mean minimum temperature of evaporation	—	48·0	47·2	50·13	57·43	60·71	65·69	67·4	66·2	63·6	57·75	50·5	47·7	56·85
Quantity of rain in each month — on the ground	—	4·96	0·87	0·21	0·100	0·00	0·00	0·00	1·15	2·22	9·933	3·549	5·085	Total. 28·077
Quantity of rain in each month — 20 feet above the ground	—	4·08	0·72	0·19	0·075	0·00	0·00	0·00	1·15	2·16	8·662	2·801	4·600	24·441
Greatest quantity of rain in 24 hours	—	3·13, Date 1	0·32, Date 19	0·21, Date 1	0·10, Date 22	0·00, Date 0	0·00, Date 0	0·00, Date 0	1·05, Date 15	1·65, Date 31	3·27, Date 29	1·18, Date 25	2·10, Date 19	For the year, Nov. 3·27 29

Wind.	Direction.	February. No.	February. Rain on	March. No.	March. Rain on	April. No.	April. Rain on	May. No.	May. Rain on	June. No.	June. Rain on	July. No.	July. Rain on	August. No.	August. Rain on	Sept. No.	Sept. Rain on	October. No.	October. Rain on	Nov. No.	Nov. Rain on	December. No.	December. Rain on	January No.	January Rain on	Total. No.	Total. Rain on
		Number of Days from each Point, and Number of Days on which there was Rain.																									
Direction at 9.30 a.m.	N.	1	–	2	–	1	–	1	–	–	–	11	–	4	–	3	–	4	–			1	1	1	–	29	1
	N.E.	1	–	8	2	1	–	6	–	6	–	9	–	13	–	9	1	1	–		–	2	2	5	5	61	10
	E.		–	1	–	1	–	5	1	2	–	6	–	2	–	1		9	3	4	2			2	–	33	6
	S.E.	2	1	2	1	2	–	6	–	1	–	–	–	1	–	5	–	6	–	6	2	3	1	6	2	36	7
	S.	3	1	4	–	1	–	1	–	1	–	–	–	1	–	1	–	1	1	2		3	3	2	1	26	6
	S.W.	12	4	–	–	3	–	3	–	1	–	–	–	1	–	4	–	4	–	6	5	10	7	4	1	45	17
	W.	2	1	3	1	3	–	–	–	1	–	–	–	2	–	1	–	1	–	1	–	1	1	1	–	19	3
	N.W.	6	4	10	6	18	1	7	–	11	–	5	–	7	–	10	2	5		10	6	8	3	10	3	110	25
Direction at 3.30 p.m.	N.	—		—		—		—		2		6		3		2		2		—		1		—		16	
	N.E.	1		7		3		9		7		7		12		7		1		2		2		7		65	
	E.	—		—		—		1		—		—		1		—		10		5		—		1		18	
	S.E.	2		3		3		10		4		4		1		3		3		5		4		7		49	
	S.	1		1		—		—		—		1		1		1		4		—		2		1		12	
	S.W.	16		3		6		—		1		1		3		6		3		9		11		6		65	
	W.	2		4		1		4		1		3		2		1		2		—		3		2		25	
	N.W.	4		8		12		7		13		6		7		10		4		6		8		7		92	
	—	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.		Date.	—	Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·226	27	30·261	13	30·191	17	30·172	10	30·122	14	30·213	8	30·195	14	30·142	1	30·195	28	30·292	8	30·112	4	30·153	27	30·153	Jan. 27
	3.30 p.m.	–	–	–		–	–	–	–	–	–	–	–	–	–	–	–			–		–		–	–		
Minimum height of barometer (observed)	9.30 a.m.	–	–	–	–	–	–	–	–	29·733	24	–	–	–	–	29·659	12	29·814	7	–						–	Feb. 1
	3.30 p.m.	29·232	1	29·321	19	29·677	29	29·541	6	–	–	29·861	20	29·845	10	–	–			29·645	15	29·669	1	29·527	12	29·232	
Extreme range of barometer (observed)	–	0·994	–	0·910	–	0·514	–	0·631	–	0·389	–	0·352	–	0·350	–	0·483	–	0·381	–	0·647		0·443		0·926		1·221	Range
Maximum temperature of the air	–	–	–	70·0	17	77·5	22	83·0	16	87·0	25	102·0	21	97·0	7	93·0	12	84·5	12	80·0	16	68·0	8	67·0	10	–	
Minimum temperature of the air	–	46·0	27	58·0	27	49·0	18	53·5	3	58·0	11	63·0	7	66·0	14	62·0	30	56·0	6	49·0	28	46·0	29	44·0	29	44·0	Jan. 29
Extreme range of temperature	–	–	–	12·0	–	28·5	–	29·5	–	29·0	–	39·0	–	31·0	–	31·0	–	28·5	–	31·0	–	22·0	–	23·0	–	–	
	1853	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January		1854.	

OBSERVATIONS made by Captain Craigie, Lieutenant Ravenhill, R.E., and Sergeant Drew, R.S.M., under the direction of Lieutenant-Colonel Thompson, R.E., Commanding Royal Engineers.

Malta.

Latitude 35° 53′ 49″ N. Longitude 14° 30′ 28″ E. Height above the sea, to the 7th of March, 201 ft. 5 in.; from the 8th of March to the 20th of June, 150 ft. 7 in.; from the 20th of June, 234 ft.

Remarks.

1853:

March.—The R.E. office being changed upon the 7th of this month, the barometer was removed on that day, and fixed in the new office, at the Governor's palace, at a height of 150 feet 7 inches above the sea.

April.—On the 6th, orange trees in blossom; 17th, spring flight of quails very abundant.

June.—Barometer removed to Valeta on the 20th, and placed on the top of St. John's Cavalier, at 4, p.m., at a height of 234 feet above the sea.

August.—A comet, visible in the west from sunset till 9, or 9.30, p.m. First seen on the 20th.

September.—Numerous flights of quails about the 18th.

ST. GEORGE'S BERMUDA.

ST. GEORGE'S, BERMUDA.

Latitude 32° 22′ 57″ N. Longitude 64° 40′ 0″ W.

From daily observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	30·068	—	—	30·064	30·102	30·162	—	—	—	—	—		
	3.30 p.m.	30·072	—		30·106	30·075	30·213	—	—	—	—	—	—	—
Mean range of barometer (observed)	—	0·004	—	—	0·042	0·027	0·051	—	—	—	—	—	—	—
Mean temperature of the air for each month and for the year, at	9.30 a.m.	61·9	—	—	72·32	80·1	83·1		—	—	—	—	—	—
	3.30 p.m.	62·1	—	—	72·45	78·3	82·3	—	—	—	—	—		
Mean humidity for each month and for the year, at	9.30 a.m.	56·0	—	—	66·9	74·5	76·7	—	—	—	—	—	—	
	3.30 p.m.	56·8	—	—	67·45	73·3	76·3		—	—	—	—	—	—
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	0·391	—	—	0·781	0·770	0·785	—	—	—	—	—	—	—
	3.30 p.m.	0·410	—	—	0·785	0·792	0·757	—	—	—	—		—	
Mean maximum temperature of the air	—	66·86	—	—	75·49	83·6	86·7	—	—	—	—	—		—
Mean minimum temperature of the air	—	43·45		—	65·47	70·9	73·75	—	—	—	—	—		—
Approximate mean temperature of the air	—	55·15	—	—	70·48	77·25	80·22	—	—	—	—	—	—	
Mean maximum temperature in the sun	—	77·7	—	—	92·87	96·5	—	—	—	—	—	—	—	
Mean minimum temperature on the grass		57·7	—	—	62·5	68·5	72·3	—	—	—	—	—	—	
Mean maximum temperature of evaporation	—	58·59	—	—	69·29	75·0	80·0	—	—	—	—	—		—
Mean minimum temperature of evaporation		57·74		—	63·48	68·5	71·3	—	—	—	—	—	—	—
Quantity of rain in each month — on the ground	—	3·46	—	—	2·84	7·39	3·864	—	—					Total. —
Quantity of rain in each month — 20 feet above the ground	—	3·48	—	—	2·565	7·09	3·201	—			—			—
Greatest quantity of rain in 24 hours	—	0·87 Date 19	— Date —	— Date —	1·64 Date 23	2·50 Date 26	1·30 Date 7	— Date —	— Date —	— Date —	— Date —	— Date —	— Date —	For the year —

Wind.	Direction.	February. No.	February. Rain on	March. No.	March. Rain on	April. No.	April. Rain on	May. No.	May. Rain on	June. No.	June. Rain on	July. No.	July. Rain on	August. No.	August. Rain on	Sept. No.	Sept. Rain on	October. No.	October. Rain on	Nov. No.	Nov. Rain on	December. No.	December. Rain on	January. No.	January. Rain on	Total. No.	Total. Rain on
Direction at 9.30 a.m.	N.	3	–		–	–	–	2	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		–
	N.E.	10	1		–	–	–	10	3	14	4	1	–	–	–	–	–	–	–	–	–	–	–	–	–		–
	E.	1	1	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–		–
	S.E.	5	–	–	–	–	–	5	1	1	–	8	2	–	–	–	–	–	–	–	–	–	–	–	–		–
	S.	–	–	–	–	–	–	–	–	–	–	3	1	–	–	–	–	–	–	–	–	–	–	–	–		–
	S.W.	2	4		–	–	–	4	1	7	4	14	9	–	–	–	–	–	–	–	–	–	–	–	–		–
	W.	1	1	–	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–		–
	N.W.	6	3	–	–	–	–	1	–	8	1	2	2	–	–	–	–	–	–	–	–	–	–	–	–		–
Direction at 3.30 p.m.	N.	2		–		–		1		–		–		–		–		–		–		–		–			
	N.E.	11		–		–		9		10		–		–		–		–		–		–		–			
	E.	–		–		–		1		1		1		–		–		–		–		–		–			
	S.E.	1		–		–		7		4		9		–		–		–		–		–		–			
	S.	–		–		–		1		–		5		–		–		–		–		–		–			
	S.W.	6		–		–		3		6		13		–		–		–		–		–		–			
	W.	1		–		–		–		1		–		–		–		–		–		–		–			
	N.W.	7		–		–		4		8		3		–		–		–		–		–		–			
	–	–	Date.		Date.	–	Date.	–	Date.		Date.	–	Date.	–	Date.	–	Date.		Date.		Date.		Date.		Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed) -	9.30 a.m.	30·382	16	–		–		–	–	30·321	20	30·379	20	–		–		–		–		–		–			
	3.30 p.m.	–	–	–		–	–	30·372	16	–	–	–		–		–		–		–		–		–			
Minimum height of barometer (observed) -	9.30 a.m.	29·377	20	–		–	–	–	–	29·842	6	–	–	–		–		–		–		–		–			
	3.30 p.m.	–	–	–	–	–	–	29·769	1	–	–	30·016	13	–		–		–		–		–		–			
Extreme range of barometer (observed) -	–	1·005		–	–	–	–	0·603	–	0·479	–	0·363		–		–		–		–		–		–			
Maximum temperature of the air - - -	–	72·5	8	–	–	–	–	80·0	26	85·5	24	90·5	1	–	–	–	–	–	–	–	–	–	–	–	–		
Minimum temperature of the air - - -	–	49·0	26		–	–	–	55·0	2	65·0	14	70·75	12	–	–	–	–	–	–	–	–	–	–	–	–		
Extreme range of temperature - - -	–	23·5		–	–	–	–	25·0	–	20·5	–	19·75	–	–	–	–	–	–	–	–	–	–	–	–	–		
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January		1854.	

OBSERVATIONS made by Corporals Birmingham and Robertson, R.S.M., under the directions of Colonel Phillpotts and Lieutenant Greatorex, R.E., Commanding Royal Engineers.

St. George's, Bermuda.

Latitude 32° 22′ 57″ N. Longitude 64° 40′ W. Height above the sea 122½ feet.

1853 :

No Remarks during the year.

NASSAU, BAHAMAS.

NASSAU, BAHAMAS.

Latitude 25° 4′ 0″ N. Longitude 77° 22′ 0″ W.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	30·200	30·195	30·164	30·132	30·140	—	30·042	30·020	30·073	30·031	30·071	30·234	—
	3.30 p.m.	30·192	30·664	29·708	30·087	30·100	—	30·015	29·987	29·956	29·984	29·845	30·189	—
Mean range of barometer (observed)	—	0·008	0·531	0·456	0·045	0·040	—	0·027	0·033	0·117	0·047	0·226	0·045	—
Mean temperature of the air for each month and for the year, at	9.30 a.m.		—	75·05	78·28	79·35	—	83·71	82·8	81·2	77·7	—		—
	3.30 p.m.		—	74·96	78·83	76·72	—	84·5	83·1	81·9	77·5	68·7	—	—
Mean humidity for each month and for the year, at	9.30 a.m.	—	—	66·34	69·87	72·57	—	79·4	78·0	76·3	72·6	—	—	—
	3.30 p.m.	—	—	67·39	73·98	72·84	—	78·3	77·8	76·5	72·8	68·6	—	—
Mean temperature of evaporation for for each month and for the year, at	9.30 a.m.	—	—	0·695	0·627	0·711	—	0·741	0·779	0·808	—	—		—
	3.30 p.m.	—	—	0·702	0·769	0·752	—	0·747	0·773	0·773	—			—
Mean maximum temperature of the air	—	72·7	80·4	81·55	82·13	83·06		87·0	85·0	83·7	79·6	71·4		—
Mean minimum temperature of the air	—	63·7	65·9	69·64	69·50	70·83	—	76·0	76·1	74·9	73·1	66·9	70·5	—
Approximate mean temperature of the air		68·2	73·1	75·59	75·81	76·94	—	81·5	80·5	79·3	76·3	70·6	—	—
Mean maximum temperature in the sun		—	—	93·85	96·22	96·44	—	107·5	—	—	—	—		—
Mean minimum temperature on the grass	—	62·8	68·0	62·82	64·28	—		—	—	—	—	—		—
Mean maximum temperature of evaporation	—	—	—	75·54	73·86	75·12		70·4	79·1	76·9	72·6	67·2	—	
Mean minimum temperature of evaporation		69·7	64·6	67·04	—	—	—	—	—	—	—	—		—
Quantity of rain in each month, on the ground	—	0·50	0·58	2·536	0·758	8·019	—	8·31	10·81	5·91	2·64	1·21	0·91	Total.
Quantity of rain in each month, 8 feet above the ground	—	0·42	0·65	2·518	0·545	8·135	—	7·91	10·52	5·58	2·37	1·14	0·95	
Greatest quantity of rain in 24 hours	—	0·24, Date 20	0·65, Date 2	1·47, Date 10	0·70, Date 16	4·02, Date 14	—, Date —	3·28, Date 29	3·75, Date 28	1·24, Date 19	0·76, Date 26	1·01, Date 31	0·62, Date 10	For the year —

Wind.	Number of Days from each Point, and Number of Days on which there was Rain.																									Total.	
	Direction.	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No	Rain on	No.	Rain on
Direction at 9.30a.m.	N.	2	1	1	–	2	1	1	–	1	–	–	–	–	–	–	–	1	1	7	2	5		2	1	–	–
	N.E.	4	2	3	–	11	1	19	2	11	4	–	–	1	1	6	4	6	1	10	3	6	–	5	2	–	–
	E.	4	–	1	1	3	1	1	–	7	2	–	–	11	6	12	7	13	3	10	1	2	–	8	–	–	–
	S.E.	10	2	9	–	7	1	1	–	6	4	–	–	11	7	6	2	2	–		–	2		6	1	–	–
	S.	2	–	1	–	2	–	1	–	4	4	–	–	3	–	5	3	3	2		–	2	–	3	–	–	–
	S.W.	1	–	–	–	1	–	–	–	–	–	–	–	2	1	–	–	1	2		–	1	3	2	–		
	W.	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1	1	2	–	–		–	–
	N.W.	4	2	3	–	1	–	2	–	–	–	–	–	–	–	1	1	–	–	1	1	6	–	–	–	–	
Direction at 3.30 p.m.	N.	3		1		4		2		3		—		1		—		2		3		4		—		—	
	N.E.	5		1		14		16		11		—		1		7		8		10		4		—		—	
	E.	3		5		3		1		4		—		5		13		8		10		2		—		—	
	S.E.	11		8		4		3		10		—		15		3		1		—		2		—		—	
	S.	1		—		1		—		2		—		4		4		3		—		2		—		—	
	S.W.	1		—		—		—		—		—		—		1		5				3		—		—	
	W.	—		—		—		—		—		—		—		1		1		1		4		—		—	
	N.W.	4		5		3		1		—		—		—		—		–		1		9		—		—	
	—	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	–	Date.	—	Date.	–	Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	–	30·324	26	30·353	7	30·333	9	30·197	12	30·254	21	–	–	30·148	3	30·103	9	30·144	26	30·314	18	30·315	6	–		–	–
	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		–			–			30·419	30	–	
Minimum height of barometer (observed)	–	–	–	30·060	2		–	–	–	–	–	–	–	–	–	–	–	–	–		–	29·830	9	–	–	–	–
	–	29·964	23	–	–	29·996	4	30·021	17	30·001	8	–	–	29·894	20	29·838	22	29·037	21	29·673	12	–	–	30·025	10	–	–
Extreme range of barometer (observed)	–	0·360	–	0·293	–	0·340	–	0·176	–	0·253	–	–	–	0·254	–	0·265	–	1·107	–	0·741		0·485	–	0·124	–	–	Range
Maximum temperature of the air	–	82·0	24	86·5	17	85·5	22	87·79	29	85·79	30	–	–	90·0	18	87·5	17	87·5	5	85·0	6	78·0	9	–		–	–
Minimum temperature of the air	–	57·0	26	63·4	18	61·3	6	66·44	2	67.44	14	–	–	71·0	29	72·0	28	69·5	19	67·0	28	55·3	30	58·0	2	–	–
Extreme range of temperature	–	25·0	–	23·1	–	24·2	–	21·35	–	18·35	–	–	–	19·0	–	15·5	–	18·0	–	18·0	–	22·7	–	–	–	–	Range
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January		1854.	

OBSERVATIONS made by Captains Rimmington, Scott, Lieutenant Heygate, and Mr. Coleman, C.W., under the directions of Captains Rimmington, Scott, and Lieutenant Heygate, R.E., Commanding Royal Engineers.

Nassau, Bahamas.

Latitude 25° 4′ 0″ N. Longitude 77° 22′ 0″ W. Height above the sea, February, March, April, and May 1853, 100 feet; June, 67; August, 30; September and October, 25; December, 20; and January 1854, 30 feet.

Remarks.

1853:

March.—Observations from the 22nd to the 31st discontinued on account of the very serious illness of Captain Rimmington, the preparations for his departure for England, and consequent removal of the Royal Engineers' office.

April.—Coughs, colds, influenza, and cholera very prevalent this month. Observations very much interrupted by sickness among the officers of the department. Orange, pine apple, and other fruit trees in blossom.

May.—The observations interrupted between the 4th and the 9th by sickness. Scarlet fever has been very prevalent among children.

June.—Pine apple harvest commenced upon the 1st, the rainy season on the 3d. The rains are said to be a fortnight later this year than usual.

August.—A comet seen every night from the 25th to the 30th. Yellow fever very prevalent during this month; some cases accompanied with black vomit. Pigeons arrived all this month. Pine apples in season.

September.—Yellow fever prevalent. Fruit season commenced in the beginning of this month. Oranges ripe by the 8th.

October.—A most tremendous hurricane, lasting from the 21st to the 24th of this month.

November.—On the 22d the wind increased to a hurricane; the barometer fell very low, and the mercury oscillated very much, between the hours of 5 p.m., on the 22d, and 1 a.m., on the 23d. The night was excessively dark, and the wind came in squalls.

December.—Arrival of wild ducks, geese, and plovers. The trees generally shedding their leaves.

1854:

January.—NOTE. Observations for November, December, (1853,) and January, (1854,) not quite full, on account of the instruments not being in good condition.

NOTE on the Barometer by an Observer at Harbour Island.

1. In hurricane months, if the barometer falls with a N. or N.E. wind, it should awaken attention; and if it falls below 29·90 it is almost certain a gale is approaching, though perhaps hundreds of miles off.

2. During its approach the barometer falls from noon till morning and then rises to noon again, every day falling lower than the preceding.

3. From sunrise to noon any rise less than ·05 is unimportant, but the slightest fall during that period certainly indicates bad weather.

4. On the contrary, from noon till morning its fall is not conclusive of bad weather, but its rise certainly indicates improved weather.

5. Though the weather be ever so threatening at sunset, the rise of ·05 or upwards assures you there will be no gale before morning.

6. Though the weather be ever so fair in the morning, the fall of ·05 before noon betokens a gale before night (provided it is already below 29·90).

HONG KONG, CHINA.

HONG KONG, CHINA.

Latitude 22° 16′ 20″ N. Longitude 114° 9′ 46″ E.

From daily Observations.	Hours of Observation	1853.											1854.	Means for the Year.
		Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	January.	
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	30·187	30·083	29·966	29·908	29·802	29·630	29·714	29·835	30·046	30·047	30·191	30·210	29·970
	3.30 p.m.	30·084	29·980	29·885	29·841	29·732	29·580	29·683	29·763	29·937	29·966	30·070	30·105	29·885
Mean range of barometer (observed)		0·103	0·103	0·081	0·067	0·070	0·050	0·061	0·072	0·109	0·081	0·121	0·105	0·085
Mean temperature of the air for each month and for the year, at	9.30 a.m.	59·6	68·9	76·6	80·5	85·4	85·9	83·3	84·6	78·6	73·9	63·4	63·1	75·34
	3.30 p.m.	62·1	71·5	82·5	80·0	85·0	86·0	86·0	84·8	80·1	76·0	64·8	66·0	77·06
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	55·8	—	—	76·3	80·1	80·7	80·1	78·3	72·8	69·8	61·0	58·9	—
	3.30 p.m.	56·6	—	—	74·3	76·3	80·3	80·4	78·7	73·9	71·1	60·6	60·6	
Mean humidity for each month and for the year, at	9.30 a.m.	0·77	—	—	0·68	0·78	0·80	0·78	0·75	0·76	0·83	0·81	0·78	—
	3.30 p.m.	0·73	—	—	0·60	0·79	0·78	0·77	0·76	0·75	0·80	0·78	0·73	—
Mean maximum temperature of the air		64·0	74·03	80·01	86·23	87·26	87·3	87·5	86·68	81·39	76·12	66·38	67·0	78·65
Mean minimum temperature of the air	—	53·04	62·27	70·63	76·65	79·98	80·8	81·1	79·58	74·75	71·18	60·01	58·0	70·66
Approximate mean temperature of the air		58·52	68·15	75·32	81·44	83·62	83·79	84·6	83·13	77·96	73·65	63·24	62·5	74·66
Mean maximum temperature in the sun	—		—	—		—	—	120·0	108·0	102·0	106·5	97·1	108·0	
Mean minimum temperature on the grass	—	51·0	63·0	72·0	77·0	73·0	79·0	78·0	77·0	71·0	69·0	60·38	56·5	68·869
Mean maximum temperature of evaporation	—	53·86	—	72·85	77·0	79·87	80·9	81·7	80·91	75·73	79·53	63·54	62·0	
Mean minimum temperature of evaporation	—	51·18	59·91	70·6	73·78	76·38	77·2	78·1	76·33	71·02	68·52	58·48	56·0	68·12
Quantity of rain in each month, on the ground	—	0·877	0·31	1·15	—	—	—	—	—	—	—	—		Total.
Quantity of rain in each month, 20 feet above the ground			—	—	5·95	9·23	28·65	0·58	18·54	2·27	10·59	3·12	0·09	
Greatest quantity of rain in 24 hours	—	0·42, Date 1	0·22, Date 26	0·85, Date 4	1·57, Date 29	4·71, Date 12	6·72, Date 12	0·32, Date 26	7·73, Date 10	0·60, Date 6	3·30, Date 20	1·80, Date 8	0·04, Date 26	For the year Sept 7·73 10

Wind.	Direction.	February. No.	Rain on	March. No.	Rain on	April. No.	Rain on	May. No.	Rain on	June. No.	Rain on	July. No.	Rain on	August. No.	Rain on	Sept. No.	Rain on	October. No.	Rain on	Nov. No.	Rain on	December. No.	Rain on	January. No.	Rain on	Total. No.	Total. Rain on
Direction at 9.30 a.m.	N.	–	–	–		–		–			–	–	–	2	1	–	–	3	–	–	–	1		2	–	8	1
	N.E.	11	2	10	2	4	2	8	4	2	1	2	1	5	1	6	3	12	3	8	2	17	6	12	–	100	27
	E.	5	1	5	1	6	3	5	2	7	3	9	4	4	1	6	2	5	2	8	4	3		11	2	74	25
	S.E.		–	2	1	7	2	6	3	4	3	8	6	1	–	7	5	8	2	7	5	6	1	6	1	62	29
	S.		–		–		–	–	–	–		–	–	1	–	1	1	3	–	1	–	–	–	–	–	6	2
	S.W.	–	–				1			2	1	3	2	3	–	–	–	–	–	2	2	–			–	11	6
	W.	2	–	–	–	–		1	1	1	–			3	1	1	–	–	–	–	–		–	–	–	8	2
	N.W.	–	–		–	–	–	2	2			1		2	–	1	–	–	–	2	1	4	2	–	–	12	5
Direction at 3.30 p.m.	N.	1				–						–		–		–		1		–		2		2		6	
	N.E.	12		16		5		9		–		1		5		1		8		12		11		11		91	
	E.	6		6		4		3		9		13		2		10		7		8		3		4		75	
	S.E.	1		1		10		6		5		3		1		10		7		5		4		8		61	
	S.	–				–		1		–		–		–		–		–		–		–		–		1	
	S.W.			3		2		–				2		10		1		–		1		–		–		19	
	W.			–		1		2		3		1		1		–		–		–				–		8	
	N.W.	4		1				3				2		2		2		–		–		6		1		21	
	–	–	Date.		Date.	–	Date.		Date.		Date.	–	Date.	–	Date.	–	Date.	–	Date.		Date.		Date.		Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·158	25	30·295	19	30·136	1			29·945	15	29·813	8	29·847	13	30·005	25	30·216	28	30·131	23	30·171	27	30·383	25	30·471	Dec 27
	3.30 p.m.	–				–		30·055	21																		
Minimum height of barometer (observed)	9.30 a.m.			–				29·749	28																		
	3.30 p.m.	29·929	21	29·860	25	29·696	30	–		29·587	10	29·340	21	29·512	1	29·653	12	29·833	1	29·871	19	29·951	20	29·871	18	29·340	July 21
Extreme range of barometer (observed)	–	0·529		0·345		0·440		0·306		0·358		0·503		0·305		0·352	–	0·383		0·260		0·517	–	0·512		1·131	Range.
Maximum temperature of the air	–	74·0	10	80·5	28	86·0	30	89·0	7	90·0	21	93·0	7	90·5	18	93·5	6	89·0	5	81·0	9	73·1	1	78·0	31	93·5	Sep. 6
Minimum temperature of the air	–	42·0	24	54·0	1	62·0	5	74·0	21	74·0	3	77·0	11	79·0	22	75·5	9	64·0	9	68·0	30	41·0	29	48·5	25	41·0	Dec. 29
Extreme range of temperature	–	32·0		26·5	–	24·0		15·0		16·0	–	16·0	–	11·5		18·0		25·0	–	13·0		32·1		30·5		52·5	Range.
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January		1854.	

OBSERVATIONS made by Corporals Fraser and Press, R.S. and M., under the direction of Captain W. E. D. Broughton, R.E., Commanding Royal Engineers.

Hong Kong, China.

Latitude 22° 16′ 20″ N. Longitude 114° 9′ 46″ E. Height above the sea 20 feet.

Remarks.

1853:

July.—This month has been remarkable for the varieties of temperature and pressure, the great quantity of rain that has fallen, and the violent gusts of wind.

August.—A very fine comet was observed in the N.W., on Sunday, the 21st, which remained visible during the rest of the month.

UP PARK CAMP, JAMAICA.

UP PARK CAMP, JAMAICA.

Latitude 17° 59′ 54″ N. Longitude 76° 56′ 30″ W.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	1854. Jan.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea for each month, and for the year, at	9.30 a.m.	30·135	30·132	30·065	30·041	30·076	30·127	30·049	30·049	30·033	30·004	30·031	30·156	30·074
	3.30 p.m.	30·016	30·047	30·001	29·981	30·027	30·048	30·009	29·991	29·955	29·925	29·967	30·132	30·010
Mean range of barometer (observed) -	- -	0·089	0·085	0·064	0·060	0·049	0·079	0·040	0·058	0·078	0·079	0·064	0·024	0·064
Mean temperature of the air for each month and for the year, at	9.30 a.m.	75·4	78·2	78·6	79·9	81·84	81·5	80·2	80·6	82·168	80·0	78·5	76·7	79·467
	3.30 p.m.	81·3	81·0	82·3	83·2	85·6	85·4	81·6	84·05	86·039	84·14	83·6	85·0	83·852
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	70·2	71·8	73·6	75·4	75·93	76·18	75·9	75·4	75·442	74·4	72·6	69·9	73·896
	3.30 p.m.	73·8	75·1	75·2	77·4	77·4	76·4	76·7	77·69	77·912	76·6	75·7	74·3	76·186
Mean humidity for each month and for the year, at	9.30 a.m.	0·789	0·745	0·794	0·816	0·773	0·779	0·829	0·792	0·744	0·778	0·764	0·754	0·778
	3.30 p.m.	0·710	0·666	0·722	0·767	0·689	0·668	0·806	0·759	0·699	0·749	0·681	0·612	0·710
Mean maximum temperature of the air -	-	84·0	86·4	85·5	86·9	89·56	89·7	86·2	87·4	89·951	88·58	87·45	84·0	87·136
Mean minimum temperature of the air -	-	66·8	69·9	71·9	72·9	74·5	73·6	73·5	74·0	74·213	71·51	67·84	69·6	71·688
Approximate mean temperature of the air		75·4	78·15	78·7	79·9	82·03	81·65	79·85	80·7	82·082	80·015	77·645	76·8	79·412
Mean maximum temperature in the sun -		94·1	96·0	95·0	99·5	99·9	105·8	105·3	100·06	103·174	99·5	101·29	102·8	100·03
Mean minimum temperature on the grass	-	61·4	65·5	67·4	68·9	70·89	64·5	61·8		—				—
Mean maximum temperature of evaporation		76·2	77·0	78·0	79·6	79·9	79·8	79·3	73·1	79·468	79·8	77·18	74·2	77·795
Mean minimum temperature of evaporation	—	64·6	66·6	66·9	71·2	71·7	72·5	72·6	71·1	71·016	66·41	67·7	65·9	69·018
Quantity of rain in each month - on the ground	-	1·27	0·16	1·89	4·75	3·81	1·4	8·10	0·96	1·35	7·01	2·891	0·72	Total. 34·311
Quantity of rain in each month - 40 feet above the ground -		1·11	0·12	1·33	1·00	2·53	0·8	6·9	0·98	1·05	6·79	2·7	0·57	25·880
Greatest quantity of rain in 24 hours -	—	1·27, Date 7	0·07, Date 20	0·67, Date 9	1·16, Date 21	1·75, Date 28	0·7, Date 31	2·00, Date 7	0·50, Date 8	0·47, Date 22	2·10, Date 14	2·03, Date 7	0·43, Date 31	For the year. 2·10, Date 14

Wind.	Direction.	February No.	February Rain on	March No.	March Rain on	April No.	April Rain on	May No.	May Rain on	June No.	June Rain on	July No.	July Rain on	August No.	August Rain on	Sept. No.	Sept. Rain on	October No.	October Rain on	Nov. No.	Nov. Rain on	December No.	December Rain on	January 1854 No.	January 1854 Rain on	Total No.	Total Rain on
		Number of Days from each Point, and Number of Days on which there was rain.																									
Direction at 9.30 a.m.	N.	9	1	5	–	2	–	1	–	8	1	8	2	6	–	2	1	6	2	6	1	6	–	3	–	62	8
	N.E.	7	–	3	1	5	2	11	6	7	1	11	–	8	2	13	–	12	–	19	2	19	2	22	3	137	19
	E.	–	–		–	3		2	1	–	–	–		3	–	1	–	3	–	2	1	2	2	2	–	18	1
	S.E.	6	–	9	1	10	2	13	3	13	1	6	–	14	6	9	1	8	2	3	2	3	1	4	–	98	19
	S.	–		3	–	1	–		–	1	–		–	–	–	1	–	1	1	–	–	–	–	–	–	7	1
	S.W.	3	–	1	–	3	–	–	–	–		1	–	–	–	1	1	–	–		–	–	–	–	–	12	1
	W.	–	–	1	–	1	1	–	–	–		1	–	–	–	2	–	–	–	–	–	1	–	–	–	6	1
	N.W.	–		6	1	5	2	4	3	1	–	4	1	–	–	1	–	1	–	–			–	–	–	22	7
Direction at 3.30 p.m.	N.	–		1		5		1		2		4		3		1		2		5		7		1		35	
	N.E.	–		1		4		9		–		2		1		1		3		1		1		5		31	
	E.	–		1		2		1		1		1		–		1		1		–		1		–		9	
	S.E.	11		23		11		16		23		22		23		19		24		21		16		23		232	
	S.	7		3						2				1		5		–		1		1		–		20	
	S.W.	6				1		–		–		1		–		–		–		1						9	
	W.	–		–		2				–		–		–		3		–		–		–		–		5	
	N.W.	2				5		–		2		1		–		–		1		1		1		2		18	
		–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.	–	Date.		Date.		Date.	–	Date.	–	Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·294	16	30·119	10	30·157	17	30·118	28	30·122	21	30·755	20	30·121	9			30·156	11	30·102	3	30·121	3	30·210	25	30·755	July 20
	3.30 p.m.		–			–	–		–			–	–	–		30·155	10				–	–		–	–	–	
Minimum height of barometer (observed)	9.30 a.m.	–		–	–		–	–		–	–	–	–	–			–					–		–		–	Nov. 23
	3.30 p.m.	29·986	18	29·998	27	29·888	30	29·904	1	29·938	7	29·987	18	29·866	23	29·906	21	29·849	7	29·801	23	29·900	11	29·989	10	29·801	
Extreme range of barometer (observed)	–	0·308	–	0·121		0·269	–	0·214		0·181	–	0·768	–	0·255	–	0·249	–	0·307		0·298	–	0·221		0·221	–	0·951	Range
Maximum temperature of the air	–	88·5	5	90·0	11	89·5	30	90·0	14	95·0	16	93·0	14	92·5	1	91·2	3	94·0	13	91·5	25	91·5	20	89·0	5	95·0	June 16
Minimum temperature of the air	–	64·5	15	68·0	2	69·5	15	70·5	21	71·0	16	69·0	4	68·5	1	70·0	20	71·0	12	68·5	30	61·0	13	66·0	30	61·0	Dec. 13
Extreme range of temperature	–	24·0	–	22·0	–	20·0	–	19·5	–	24·0	–	24·0	–	24·0	–	21·2	–	23·0	–	23·0	–	27·5	–	23·0		31·0	Range
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January 1854.			

OBSERVATIONS made by Lieutenant Cox, R.E., and Messrs. White, Gardiner, Oxley, and Brave, under the direction of Lieutenant-Colonel Yule, R.E., Commanding Royal Engineers.

Up Park Camp, Jamaica.

Latitude 17° 59′ 54″ N. Longitude 76° 56′ 30″ W. Height above the sea 225 feet.

Remarks.

1853 :

February.—Wind gauge taken down on the 21st.

March.—On the 7th, the wind in swirls veered completely round the compass. The white oak, Barbadoes pride, tamarind, star apples, oranges, jappadilloes, &c. in flower. In Kingston, an unusual amount of remittent and intermittent fevers ; also a few cases of yellow fever ; a bad type among new comers, and very fatal among sea-farers.

April.—Yellow fever still prevalent, and is very fatal among sea-farers. A few cases among the new comers ashore, but the general health of the town is better than last month.

May.—Yellow fever still prevalent ; also a few cases of remittent and intermittent fever, and some bowel complaints.

June.—Yellow fever unabated. Typhus fever and hooping cough prevalent among the inhabitants of Kingston.

July.—A few cases of yellow fever this month. Remittent fever and hooping cough prevalent. An eruption of boils have also been common for several weeks.

August.—Fever, of a typhoid character and very severe, has been prevalent during the month.

September.—Hooping cough and catarrh prevalent. One or two cases of sporadic cholera (not Asiatic) have been reported, but none fatal.

October.—Remittent and intermittent fevers have been prevalent during this month among the black troops.

BARBADOES.

BARBADOES.

Latitude 13° 4′ 37″ N. Longitude 59° 40′ 8″ W.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	29·619	29·652	29·617	29·625	29·663	29·660	29·614	29·605	29·574	29·558	29·558	29·641	29·615
	3.30 p.m.	29·588	29·622	29·577	29·588	29·624	29·640	29·584	29·569	29·509	29·483	29·466	29·583	29·569
Mean range of barometer (observed)		0·031	0·030	0·040	0·037	0·039	0·020	0·030	0·036	0·065	0·075	0·092	0·058	0·046
Mean temperature of the air for each month and for the year, at	9.30 a.m.	78·14	81·18	82·87	83·21	82·9	83·4	83·0	83·2	81·3	81·0	80·9	80·0	81·75
	3.30 p.m.	80·7	81·8	83·7	83·53	79·99	83·6	82·9	83·6	82·7	81·4	82·6	82·1	82·38
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	68·4	72·49	73·89	76·92	76·99	77·8	77·1	77·3	76·9	76·6	77·1	74·3	75·48
	3.30 p.m.	72·8	72·79	74·7	76·58	76·73	77·5	77·4	77·9	76·8	76·7	78·2	75·7	76·15
Mean humidity for each month and for the year, at	9.30 a.m.	0·704	0·668	0·657	0·731	0·750	0·770	0·780	0·857	0·775	0·779	0·833	0·767	0·756
	3.30 p.m.	0·695	0·654	0·647	0·725	0·735	0·752	0·779	0·737	0·756	0·794	0·810	0·738	0·735
Mean maximum temperature of the air		83·4	84·2	86·3	86·0	85·9	85·8	85·9	85·8	84·8	87·3	85·0	83·9	85·358
Mean minimum temperature of the air		73·7	75·4	76·5	78·0	78·4	77·8	76·7	77·0	76·5	76·5	76·2	74·2	76·408
Approximate mean temperature of the air		78·55	79·8	81·1	82·0	82·15	81·8	81·3	81·4	80·65	81·9	80·6	79·05	80·883
Mean maximum temperature in the sun		105·8	102·9	109·3	111·3				—					
Mean minimum temperature on the grass	—	—		—	—					73·0	69·6	62·4	60·7	—
Mean maximum temperature of evaporation	—	74·5	71·6	76·1				—	—					—
Mean minimum temperature of evaporation	—	69·4	70·3	71·5					—	—		—		—
Quantity of rain in each month — on the ground	—	4·34	2·10	1·11	13·41	3·36	3·00	5·13	7·55	8·59	9·23	9·23	1·19	Total. 68·24
Quantity of rain in each month — 20 feet above the ground		3·91	1·51	0·98	11·27	2·89	2·34	4·10	6·91	8·58	8·00	8·00	0·61	59·13
Greatest quantity of rain in 24 hours	—	2·47, Date 3	0·47, Date 11	0·45, Date 24	3·64, Date 22	0·60, Date 24	0·43, Date 13	1·10, Date 21	4·05, Date 18	2·31, Date 4	2·15, Date 17	0·30, Date 20	0·25, Date 28	For the year, Sept 4·05 18

Wind. Number of Days from each Point, and Number of Days on which there was Rain.

Wind	Direction	Feb. No.	Feb. Rain on	Mar. No.	Mar. Rain on	Apr. No.	Apr. Rain on	May No.	May Rain on	June No.	June Rain on	July No.	July Rain on	Aug. No.	Aug. Rain on	Sept. No.	Sept. Rain on	Oct. No.	Oct. Rain on	Nov. No.	Nov. Rain on	Dec. No.	Dec. Rain on	Jan. No.	Jan. Rain on	Total No.	Total Rain on
Direction at 9.30, a.m.	N.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	N.E.	17	2	18	8	5	1	2	1	9	4	12	8	16	8		–	1			–	1	1	5	1	86	34
	E.	1	3	9	4	13	6	10	4	9	5	17	10	10	2	27	12	27	21	28	16	23	6	26	11	203	100
	S.E.	1	3	1	2	12	2	19	9	12	7	2	1	5	5	2	1	2	2	1	1	7	1		–	70	34
	S.	–		–	–	–	–	–		–	–	–	–	–	–	1	1					–	–		–	1	1
	S.W.		–	–	–	–	–	–		–	–	–	–	–	–		–	1	1			–	–	–	–	1	1
	W.	–	–	–	–	–	–	–		–	–	–	–	–	–	–			–			–	–	–	–	–	–
	N.W.	3	–	–	–	–	–	–		–	–	–	–	–	–	–	–		–	1	1	–	–		–	1	1
Direction at 3.30, p.m.	N.	–		–		–		–		–		–		–		–		–		–		–		–		–	
	N.E.	16		8		4				9		10		15		–				–		–		–		62	
	E.	5		19		11		13		12		11		7		26		23		29		23		31		210	
	S.E.	4		4		15		18		9		10		8		4		8		1		8		–		89	
	S.	–		–		–		–		–				–		–		–		–		–				–	
	S.W.	–		–		–				–		–		1		–		–				–		–		1	
	W.	–		–				–				–		–		–						–		–		–	
	N.W.	3		–				–				–				–		–		–				–		3	

		Feb.	Date.	Mar.	Date.	Apr.	Date.	May	Date.	June	Date.	July	Date.	Aug.	Date.	Sept.	Date.	Oct.	Date.	Nov.	Date.	Dec.	Date.	Jan.	Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	29·689	28	29·715	5	–	–	29·799	27	29·728	2	–	–	29·831	30	29·662	3	29·621	15		–	29·648	30	29·753	21	29·799	May 27
	3.30 p.m.	–	–			29·677	17	–	–	–		29·742	8	–	–	–	–	–	–	29·661	3						
Minimum height of barometer (observed)	9.30 a.m.		–	29·532	24	–	–	–	–		–	–	–	–	–	–	–	–	–	29·415	16						
	3.30 p.m.	29·519	6	–	–	29·513	30	29·499	1	29·567	7	29·610	1	29·493	21	29·512	23	29·501	13	–		29·381	1	29·471	6	29·381	Dec. 1
Extreme range of barometer (observed)	–	0·170	–	0·183	–	0·164	–	0·300		0·161	–	0·132	–	0·338	–	0·157	–	0·117	–	0·246	–	0·267		0·262		0·418	Range.
Maximum temperature of the air	–	86·0	25	87·0	31	88·0	23	88·4	5	88·0	20	88·0	19	89·5	19	88·5	18	88·0	2	91·0	16	87·2	18	86·0	24	89·5	Nov. 16
Minimum temperature of the air		67·0	7	69·5	4	71·5	25	72·0	12	76·0	30	73·5	17	72·5	11	71·0	16	72·0	21	72·7	21	73·5	27	71·0	31	67·0	Feb. 7
Extreme range of temperature		19·0		17·5	–	16·5		16·4		12·0		14·5		17·0	–	14·5	–	16·0		18·3		13·7		15·0		[illegible]	[illegible]
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December		January		1854.	

OBSERVATIONS made by Messrs. Howel, Sanderson, and Piper, Clerks to R.E., under the direction of Lieutenant C. Musney, R.E., Commanding Royal Engineers.

Barbadoes.

Latitude 13° 4′ 37″ N. Longitude 59 40′ 8″ W. Height above the sea 4½ feet.

Remarks.

1853:

February.—Weather very disagreeable, but there is no re-appearance of the late pidemic fever.

March.—One case of yellow fever occurred in the island this month, and two in the shipping lying in Carlisle bay; all fatal. Weather still unpleasant.

July.—The thermometer attached to the barometer was broken on the 21st, but the reductions of the readings of the barometer have been made from the temperature of the air.

COLOMBO, CEYLON.

COLOMBO, CEYLON.

Latitude 6° 56′ 6″ N. Longitude 79° 49′ 18″ E.

From daily Observations.	Hours of Observation.	1853. February	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month, and for the year, at	9.30 a.m.	29·945	29·952	29·894	29·893	29·875	29·928	29·878	29·927	29·947	29·924	29·981	29·577	29·927
	3.30 p.m.	29·823	29·834	29·781	29·810	29·797	29·854	29·795	29·824	29·839	29·803	29·865	29·850	29·823
Mean range of barometer (observed)	—	0·122	0·118	0·113	0·088	0·078	0,074	0·083	0·103	0·108	0·121	0·116	·127	·104
Mean temperature of the air for each month, and for the year at	9.30 a.m.	81·0	83·6	83·7	83·6	82·7	81·1	81·9	82·5	81·9	80·5	79·1	78·9	81·7
	3.30 p.m.	84·5	86·1	85·7	84·7	83·6	82·2	82·7	83·2	82·7	82·5	83·0	83·5	83·7
Mean temperature of evaporation, for each month, and for the year, at	9.30 a.m.	75·3	78·4	79·2	80·1	78·9	77·7	77·8	78·6	78·6	77·0	74·5	74·5	77·5
	3.30 p.m.	77·3	79·5	80·1	80·4	78·9	78·1	78·0	78·4	78·5	78·2	76·8	77·2	78·1
Mean humidity for each month, and for the year, at	9.30 a.m.	0·761	0·780	0·808	0·846	0·835	0·854	0·826	0·835	0·854	0·871	0·801	0·807	·823
	3.30 p.m.	0·711	0·731	0·770	0·815	0·802	0·821	0·800	0·795	0·824	0·897	0·746	0·745	·788
Mean maximum temperature of the air	—	85·2	86·7	86·2	85·2	83·7	82·7	82·9	83·7	83·4	83·1	83·5	84·2	84·2
Mean minimum temperature of the air	—	74·7	77·0	77·3	78·9	80·1	77·7	78·9	78·1	76·8	74·5	73·3	73·1	76·7
Approximate mean temperature of the air	—	79·9	81·8	81·7	82·0	81·9	80·2	80·9	80·9	80·1	78·8	78·4	78·6	80·4
Mean maximum temperature in the sun	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mean minimum temperature on the grass	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mean maximum temperature of evaporation	—	78·5	80·5	81·2	81·9	80·4	79·4	78·9	79·6	79·7	79·1	77·7	78·3	79·6
Mean minimum temperature of evaporation	—	71·2	73·9	74·4	75·3	75·9	71·0	74·7	74·2	73·5	71·8	69·5	69·1	73·1
Quantity of rain in each month — on the ground	—	2·47	2·225	10·619	25·450	1·993	4·200	0·470	0·810	6·41	9·01	2·62	5·355	Total. 71·632
Quantity of rain in each month — 23 feet above the ground	—	2·305	2·18	10·789	24·835	1·905	3·955	0·453	0·805	5·835	8·581	2·43	5·214	69·287
Greatest quantity of rain in 24 hours	—	2·27 Date 21	1·23 Date 25	4·60 Date 12	4·87 Date 2	1·57 Date 1	2·00 Date 6	0·27 Date 6	0·30 Date 10	1·42 Date 19	2·00 Date 18	0·90 Date 12	1·84 Date 27	For the year May 4·87 2

Wind.	Number of Days from each Point, and Number of Days on which there was Rain.																									Total.	
	Direction	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on
Direction at 9.30 a.m.	N.	–	–	1	–	–																7	3	4	3	12	6
	N.E.	17	2	1	–	–														6	1	15	2	16	4	55	9
	E.	–	–	1	–	–																				1	
	S.E.	–	–	2	–	16	6	1	1																	19	7
	S.	–	–			1														1	1					2	1
	S.W.	–	–	2	2	9	7	25	21	21	8	25	12	7	1	15	6	9	5							113	62
	W.	1	–	3	–	–				4	2			18	6	10	4	8	5							44	17
	N.W.	–	–	1	1	–				1								9	8	1	1					12	10
Direction at 3.30 p.m.	N.																					11		1		12	
	N.E.	2																3		3		3		1		15	
	E.																										
	S.E.							1																		1	
	S.							3								8		11								22	
	S.W.	1		7		15		20		17		24		13		18		12		2		1				120	
	W.	1		6		9		2		9		2		12						5						46	
	N.W.	17		14		2														12		9		16		70	
	–	–	Date.	–	Date.	–	Date.		Date.		Date.		Date.	–	Date.		Date.		Date.	–	Date.		Date.	–	Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·005	19	30·010	2	30·016	1	29·978	25	29·939	21	30·00	18	29·913	3	29·907	10	30·015	10	30·007	26	30·012	28	30·077	7	30·077	Jan. 7
	3.30 p.m.	–		–		–		–		–																	
Minimum height of barometer (observed)	9.30 a.m.	–				–				–																	
	3.30 p.m.	29·781	8	29·731	26	29·709	25	29·711	1	29·739	4	29·800	2	29·728	10	29·766	28	29·766	5	29·724	1	29·733	5	29·791	30	29·709	April 25
Extreme range of barometer (observed)	–	0·222		0·276		0·307		0·217		0·200		0·200	–	0·215		0·231		0·249		0·283		0·279		0·286		0·368	Range.
Maximum temperature of the air	–	89·0	5	88·1	18	88·5	26	87·0	21	84·8	9	84·0	1	84·0	5	85·0	9	86·5	18	87·5	23	85·0	30	86·3	20	89·0	Feb. 5
Minimum temperature of the air	–	72·1	10	74·0	3	73·1	12	74·7	23	74·9	4	74·9	11	76·0	8	75·1	20	73·6	28	70·9	22	68·9	15	70·7	16	68·9	Dec. 15
Extreme range of temperature	–	16·9	–	14·1		15·4	–	12·3	–	9·9		9·1	–	8·0	–	9·6		12·9	–	16·6	–	16·1		15·6		20·1	Range.
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January		1854.	

OBSERVATIONS made by Lieutenant Phillpotts, R.E., and Lieutenant Sievewright, R.A., under the direction of Lieutenant-Colonel Hope, R.E., Commanding Royal Engineers.

Colombo, Ceylon.

Latitude 6° 56′ 6″ N. Longitude 79° 49′ 48″ E. Height above the sea 18 feet.

Remarks.

1853 :—

February.—This month has been very dry ; the days have been hot and the nights cold, the difference of temperature having been as much as 16° 9, which is the cause of the low mean temperature.

March.—During this month there has been much fever, also cholera and small pox, in the native town.

April.—The heat this month has been rendered less oppressive by occasional rains ; at times, however, it was very close, hot, and disagreeable, there having been little wind during the day. Cholera and small pox on the decline.

May.—Two brilliant meteors are reported to have been seen upon the night of the 22d. Cholera has again broken out in the native town, and also among the native troops, several cases fatal.

June.—Cholera still prevalent. Lieutenant Smith of the Rifles died of it on the 8th inst. ; his was the first case among the Europeans.

July.—Cholera has traversed the western coast of the island from north to south, and has been very fatal among the natives.

August.—The weather during this month has been very fine. A comet seen on the 23d.

September.—The weather during this month has been very agreeable ; the days were cloudy and the nights clear.

October.—Small pox prevails to an unusual degree in the native town ; and cholera has made its appearance among the inhabitants of Kandy.

November.—Small pox and cholera still prevalent in the crowded parts of the native town. A few cases of cholera in the forts. There were twelve days rain during a calm this month.

December.—The weather during the first part of this month was very agreeable, the days being cloudy and the nights cool. A very dry wind (called here "the 'longshore wind.") prevailed from the 13th to the 24th ; it is considered a very unhealthy breeze, and its effects upon furniture, &c.—causing it to crack and split—are extraordinary.

1854 :—

January.—A brilliant meteor seen upon the 27th, at 4 a.m. Cholera and small pox prevalent.

MAURITIUS.

MAURITIUS.

Latitude 20° 9′ 56″ S. Longitude 57° 28′ 41″ E.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	29·917	29·969	30·024	30·099	30·145	30·231	30·189	30·185	30·184	30·026	30·011	29·981	30·080
	3.30 p.m.	29·850	29·907	29·953	30·033	30·080	30·157	30·112	30·106	30·114	29·971	29·956	29·921	30·013
Mean range of barometer (observed)	—	0·067	0·062	0·071	0·066	0·065	0·074	0·077	0·079	0·072	0·055	0·055	0·060	0·067
Mean temperature of the air for each month and for the year, at	9.30 a.m.	83·5	81·79	79·86	77·0	74·2	72·7	75·15	75·33	75·20	79·96	83·11	84·0	78·35
	3.30 p.m.	84·7	83·08	80·55	78·14	75·36	73·98	74·5	76·73	76·8	80·61	84·03	83·3	79·51
Mean temperature of evaporation for each month and for the year, at	9.30 a.m.	75·67	73·77	71·88	70·2	67·73	64·98	66·0	67·46	67·5	72·66	71·18	75·0	70·61
	3.30 p.m.	76·2	73·8	72·28	70·9	67·78	65·35	66·3	68·28	67·58	73·35	71·80	75·8	71·03
Mean humidity for each month and for the year, at	9.30 a.m.	0·694	0·681	0·693	0·737	0·735	0·685	0·708	0·683	0·666	0·705	0·653	0·656	0·691
	3.30 p.m.	0·667	0·646	0·674	0·711	0·696	0·657	0·672	0·666	0·611	0·708	0·646	0·642	0·668
Mean maximum temperature of the air		86·1	84·18	82·13	79·5	76·73	75·11	76·1	78·06	78·967	82·20	85·307	86·9	80·96
Mean minimum temperature of the air	—	78·18	77·3	76·05	73·7	71·2	69·48	69·0	70·3	71·522	74·55	77·351	78·3	73·90
Approximate mean temperature of the air		82·29	80·89	79·09	76·6	73·965	72·295	72·55	74·18	75·144	78·375	81·33	82·6	77·44
Mean maximum temperature in the sun				—	—	—	—			—		—	—	
Mean minimum temperature on the grass		—		—	—			—	—		—	—		
Mean maximum temperature of evaporation		77·55	75·5	75·20	72·7	70·05	67·67	68·27	70·2	69·74	74·66	76·24	76·9	72·89
Mean minimum temperature of evaporation		72·9	71·4	69·08	67·3	64·63	62·19	62·38	64·4	64·11	69·38	70·61	71·6	67·50
Quantity of rain in each month, on the ground	—	5·801	1·536	5·959	6·755	8·140	0·795	0·985	0·685	0·480	0·685	0·580	1·120	Total. 39·524
Quantity of rain in each month, 28 feet above the ground		4·292	3·682	5·509	6·205	7·415	0·553	0·730	0·550	0·380	0·610	0·500	3·875	34·331
Greatest quantity of rain in 24 hours	—	2·31 Date 27	1·87 Date 16	2·87 Date 10	2·84 Date 21	2·47 Date 16	0·13 Date 25	0·59 Date 10	0·17 Date 10	0·09 Date 20	0·19 Date 4	0·22 Date 15	1·36 Date 28	For the year: 2·87 April 10

Wind.	Direction.	February No.	February Rain on	March No.	March Rain on	April No.	April Rain on	May No.	May Rain on	June No.	June Rain on	July No.	July Rain on	August No.	August Rain on	Sept. No.	Sept. Rain on	October No.	October Rain on	Nov. No.	Nov. Rain on	December No.	December Rain on	January No.	January Rain on	Total No.	Total Rain on
		Number of Days from each Point, and Number of Days on which there was Rain.																									
Direction at 9.30 a.m.	N.			–	–		–		–	–	–	1		–		2	2	–	–	2		2	1	3	2	10	5
	N.E.	6	3	4	1	6	3	5	3	2	2	–	–	1	–	4		1	1	7	2	7	1	9	1	52	17
	E.	3	2	9	3	7	4	3	3	3	2	11	8	11	7	13	11	16	7	9	3	15	4	12	5	112	57
	S.E.	14	7	10	8	13	2	14	1	17	8	15	7	16	8	9	4	10	6	2	–	1	–	4	2	125	53
	S.	–	–		–		–	–	–	–	–	1	–	–		1	–	–		1	1		–	–		3	1
	S.W.	–	–	2	–	1	1	2	1	2	–			–			–	–		–		–		–		7	2
	W.	1	–		–		–	1	–	2	1	–		1		–	–	1				1		–	–	7	1
	N.W.	4	–	4	1	3	2	6	3	1	–	1	–	1	–	–	–	3	1	9	2	5	–	3	3	40	12
Direction at 3.30 p.m.	N.	–		–		–		1		1		–		1		1		–				2		1		13	
	N.E.	3		7		4		4		4		–		3		2		3		1		10		7		51	
	E.	2		3		3		1		2		10		9		9		7		8		5		7		66	
	S.E.	13		12		15		16		19		13		14		8		17		3		4		4		138	
	S.	–		1		–		1		–		2		–		1		–		1				1		7	
	S.W.	2		4		2		2		2		1		2		–		–		1		1		1		18	
	W.	2		1		2		2		2		4		1		1		2		2		4		1		24	
	N.W.	6		1		4		3		–				1		1		2		11		5		6		43	

		1853- February.	Date.	March.	Date.	April.	Date.	May.	Date.	June.	Date.	July.	Date.	August.	Date.	Sept.	Date.	October.	Date.	Nov.	Date.	December.	Date.	January	Date.	1854. Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·003	15	30·121	20	30·126	4	30·217	26	30·260	21	30·395	19	30·280	2	30·254	1	30·262	12	30·136	1	30·082	25	30·119	15	30·395	July 19
	3.30 p.m.	–		–	–	–	–	–	–			–	–		–	–		–	–	–		–		–	–	–	
Minimum height of barometer (observed)	9.30 a.m.	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	3.30 p.m.	29·750	21	29·638	6	29·810	10	29·924	12	29·968	5	30·035	15	29·999	18	29·987	7	30·031	30	29·917	16	29·848	3	29·761	30	29·638	Mar. 6
Extreme range of barometer (observed)	–	0·253	–	0·486	–	0·316	–	0·293	–	0·292	–	0·350	–	0·281	–	0·267		0·231	–	0·139		0·234	–	0·358	–	0·657	Range
Maximum temperature of the air	–	88·0	17	88·5	10	84·5	3	81·0	9	79·0	1	77·5	2	79·5	21	80·5	26	82·0	3	86·0	29	86·5	30	89·5	17	89·5	Jan. 17
Minimum temperature of the air	–	76·0	28	73·5	15	70·5	13	71·0	20	69·0	8	67·0	15	66·0	26	67·5	22	69·5	16	71·0	8	75·5	2	76·0	27	66·0	Aug. 26
Extreme range of temperature	–	12·0	–	15·0	–	11·0	–	10·0	–	10·0	–	10·5	–	13·5	–	13·0	–	12·5	–	15·0	–	11·0	–	13·5	–	23·5	Range

OBSERVATIONS made by Lieutenant Fyers, R.E., and Private C. Bush, R. S. & M., under the direction of Lieutenant-Colonel Waters, R.E., Commanding Royal Engineers.

Mauritius.

Latitude 20° 9′ 56″ S. Longitude 57° 28′ 41″ E. Height above the sea 20 feet.

Remarks.

1853 :

February.—Out of 113 patients admitted into the civil hospital of Port Lewis this month, 16 were of fevers, 6 of pulmonary complaints, 12 rheumatisms, and 9 bowel complaints. Vegetation flourishing.

March.—This month has been very healthy.

April.—Rheumatisms, coughs, colds, and slight fevers, prevalent. The troops healthy. Vegetation flourishing.

May.—Catarrh and fever prevalent. Vegetation very flourishing. The trees are never leafless on this island: all plants are either budding, fruit-bearing, or imperceptibly changing their leaves.

June.—The most prevalent diseases during this month have been fever, catarrh, rheumatism, and dysentery.

July.—An unprecedented absence of fever has been remarked this month.

August.—The most prevalent diseases have been catarrh, fever, rheumatism, and dysentery.

September.—The most prevalent diseases this month have been catarrh, fever, and rheumatism.

October.—Fever has been prevalent this month. Rheumatism and catarrh have also been common.

November.—The most prevalent diseases this month have been fever, rheumatism, and English cholera.

December.—The most prevalent complaints this month have been fever and diarrhœa.

1854 :

January.—The most prevalent complaints this month have been rheumatism, fever, dysentery, and consumption: the deaths from the latter being above the average of many years.

FREMANTLE, W. AUSTRALIA.

FREMANTLE, W. AUSTRALIA.

Latitude 32° 15′ 0″ S. Longitude 116° 30′ 0″ E.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	29·837	30·010	30·094	30·195	30·168	29·977	30·128	30·104	30·128	29·972	29·946	30·003	30·047
	3.30 p.m.	29·796	29·954	30·053	30·140	30·127	29·928	30·085	30·068	30·083	29·918	29·942	29·951	30·006
Mean range of barometer (observed)	—	0·041	0·056	0·041	0·055	0·041	0·049	0·042	0·036	0·045	0·024	0·004	0·052	0·041
Mean temperature of the air for each month and for the year	9.30 a.m.	74·62	71·3	62·66	59·64	52·95	57·1	59·2	61·5	66·2	70·7	71·4	76·3	65·30
	3.30 p.m.	66·76	73·5	65·96	63·95	59·0	61·0	64·7	65·1	70·1	73·3	73·7	76·8	67·82
Mean temperature of evaporation for each month and for the year	9.30 a.m.	69·36	67·52	60·11	56·9	49·5	54·5	56·1	56·9	60·3	64·8	66·4	65·9	60·69
	3.30 p.m.	71·34	70·6	63·41	61·29	55·4	57·5	57·8	59·9	65·4	68·2	69·4	69·0	64·10
Mean humidity for each month and for the year	9.30 a.m.	0·742	0·832	0·868	0·887	0·899	0·826	0·843	0·781	0·733	0·751	0·780	0·619	0·797
	3.30 p.m.	0·760	0·868	0·880	0·900	0·821	0·824	0·821	0·759	0·732	0·785	0·813	0·693	0·805
Mean maximum temperature of the air		80·39	75·6	67·56	64·95	61·5	62·7	63·4	66·8	71·1	75·9	76·0	80·8	70·55
Mean minimum temperature of the air		63·18	58·1	52·85	49·53	41·83	51·5	51·5	52·0	53·5	58·8	58·9	61·5	54·68
Approximate mean temperature of the air		71·78	66·85	60·20	57·24	53·16	57·1	57·5	59·4	62·3	67·3	67·5	71·1	62·61
Mean maximum temperature in the sun	—	81·6	81·77	70·6	66·0	57·9	59·6	65·5		—	—		87·4	
Mean minimum temperature on the grass	—	80·2	77·2	68·64	65·3	62·3	62·7	64·2			—	—	82·2	—
Mean maximum temperature of evaporation		73·89	73·0	64·92	62·74	57·50	58·7	59·5	61·4	65·0	70·5	70·8	72·2	65·84
Mean minimum temperature of evaporation	—	62·34	57·6	52·6	49·22	43·7	49·8	50·5	50·1	52·1	57·7	58·1	57·4	53·43
Quantity of rain in each month — on the ground	—	1·14	0·45	3·38	4·15	4·57	11·30	3·69	4·38	0·05	0·62	0·21	·00	Total 33·94
Quantity of rain in each month — 26 feet above the ground	—	1·14	0·45		4·19	4·79	13·39	4·22	6·22	—	—		·00	
Greatest quantity of rain in 24 hours	—	Date. 0·84 21	Date. 0·27 28	Date. 1·36 1	Date. 2·70 23	Date. 1·05 13	Date. 2·94 17	Date. 0·69 11	Date. 4·15 14	Date. 0·05 5	Date. 0·40 11	Date. 0·08 21	Date. ·0 0	For the year Sept. 4·15 14

Wind.		Number of Days from each Point, and Number of Days on which there was Rain.																								Total.	
	Direction.	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on
Direction at 9.30 a.m.	N.	-	-	-	-	-	-	-		1	-	-	-	-	-	-	-	1	-		-	-	-	-	-	2	-
	N.E.	3	1	7	1	1	-	6		8	1	7	3	5	2	3	-	6	1	1	-	-		5	-	52	9
	E.	6	-	1	-	2	-	5	1	7	1	5	3	3	-	3	-	4	-	6	-	1	-	8	-	51	5
	S.E.	3	2	11	-	10	1	10	2	6	2	3	2	4	2	3	-	7	-	-	-	-	-	5	-	42	11
	S.	2	-	2	-	4	2	1		3	2	2	1	-	-	2	1	2		1	-	3	-	7	-	29	6
	S.W.	7	1	6	1	7	2	6	1	-	-	2	2	9	1	7	1	4	-	13	2	20	2	6	-	87	19
	W.	4	1	2	1	2	1			1	1	1	1	3	3	9	2	3	-	4	1	3	-	-	-	32	11
	N.W.	3	-	2	-	1	3	8	-	4	4	11	10	7	4	3	3	4	-	5	-	4	3	-	-	59	27
Direction at 3.30 p.m.	N.	—		—		—		1		2		4		1		—		—		—		—				8	
	N.E.	—		1		—		3		1		3		1		—		1		—		—		—		13	
	E.	2		—		—		1		8		—		1		2		2		1		—		—		17	
	S.E.	3		—		3		8		3		1		1		—		3		—		—		—		22	
	S.	—		—		1		1		2		3		2		—		—		—		—		1		10	
	S.W.	17		22		22		12		6		5		11		15		19		22		25		30		206	
	W.	4		4		1		2		1		4		5		6		2		5		5		—		42	
	N.W.	2		4		3		5		1		11		9		7		4		2		1				47	
	-		Date.		Date.		Date.	—	Date.	—	Date.	—	Date.		Date.		Date.		Date.	—	Date.	—	Date.		Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	30·071	1	30·207	2	30·404	30	30·428	28	30·475	23	30·261	9	30·362	21	30·393	19	30·270	1	30·189	6	30·171	24	30·161	23	30·475	June 23
	3.30 p.m.	-	-	-	-		-	-	-	-	-	-	-		-	-		-		-	-	-				-	
Minimum height of barometer (observed)	9.30 a.m.	29·559	16	-		-	-		-	-	-		-	-		29·693	6	-	-			29·706	20	-	-	-	
	3.30 p.m.	-	-	29·730	27	29·609	7	29·790	21	29·391	13	29·758	26	29·747	29			29·930	8	29·757	18	-		29·771	17	29·391	June 13
Extreme range of barometer (observed)		0·512		0·477	-	0·795	-	0·638		1·081	-	0·503		0·515	-	0·700	-	0·340	-	0·432	-	0·465	-	0·390		1·081	Range.
Maximum temperature of the air	-	101·0	13	89·0	6	71·0	1	71·0	17	74·0	2	69·0	16	68·0	8	86·0	24	92·0	17	98·0	2	83·0	31	95·0	9	101·0	Feb. 13
Minimum temperature of the air	-	55·0	10	49·5	1	42·0	24	42·0	24	36·0	9	41·0	9	45·0	25	43·0	1	40·0	9	50·0	4	52·0	28	49·0	23	36·0	June 9
Extreme range of temperature	-	46·0	-	39·5	-	32·0	-	29·0	-	38·0	-	28·0	-	23·0	-	43·0	-	52·0	-	48·0	-	31·0	-	46·0	-	65·0	Range.
	1853 -	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		December.		January		1854.	

OBSERVATIONS made by Mrs. Wray and Color-Sergeant C. Russell, R.S.M., under the direction of Lieutenant Wray, R.E., Commanding Royal Engineers.

Fremantle, Western Australia.

Latitude 32° 15′ S. Longitude 116° 30′ E. Height above the sea 16½ feet.

Remarks.

1853 :

September.—About the middle of this month a comet was observed, covering seven degrees of a large circle, and about ten degrees above the horizon—visible at day-light, due east; rising daily about its own length, and travelling W.N.W.

October.—Influenza prevalent. Large numbers of black whales passing to the southwards during this month.

November.—Influenza and intermittent fever prevalent. Ducks and wild fowl beginning to collect in the pools as the brooks dry up.

December.—Influenza still prevalent. Ducks collecting in the pools in great numbers.

AUCKLAND, NEW ZEALAND.

AUCKLAND, NEW ZEALAND.

Latitude 36° 50′ 5″ S. Longitude 174° 5′ 40″ E.

From daily Observations.	Hours of Observation.	1853. Feb.	March.	April.	May	June.	July.	August.	Sept.	October.	Nov.	Dec.	1854. January.	Means for the Year.
Mean height of the barometer at the temperature of 32°, and corrected for altitude above the mean level of the sea, for each month and for the year, at	9.30 a.m.	-			—	-			—	30·066	30·065	29·964	30·096	
	3.30 p.m.	-	-		-		—	—	—	30·062	30·038	29·916	29·867	
Mean range of barometer (observed)	- -			—	—	—	—		—	0·064	0·027	0·018	0·129	
Mean temperature of the air for each month and for the year	9.30 a.m.	67·3	66·1	60·78	57·0	49·9	51·8	53·7	56·2	60·1	63·3	66·9	72·6	60·47
	3.30 p.m.	69·1	68·4	62·7	58·1	53·2	54·4	56·9	57·2	61·7	62·7	68·2	75·6	62·35
Mean temperature of evaporation for each month and for the year	9.30 a.m.	62·9	61·0	56·9	54·2	48·1	49·4	50·5	57·3	67·9	57·7	59·3	64·0	57·43
	3.30 p.m.	63·2	62·2	56·9	54·5	50·4	51·3	53·1	55·2	59·6	58·3	60·5	62·7	57·30
Mean humidity for each month and for the year	9.30 a.m.	0·80	0·77	0·81	0·85	0·88	0·85	0·81	0·87	0·88	0.78	·70	·64	0·803
	3.30 p.m.	0·75	0·73	0·76	0·82	0·83	0·82	0·80	0·89	0·88	0·76	·65	·61	0·775
Mean maximum temperature of the air		68·2	73·4		—	58·1	58·8	63·2	62·2	66·4	68·2	73·1	-	-
Mean minimum temperature of the air		58·98	57·3	51·8	50·2	42·6	44·5	44·1	46·7	48·9	51·6	53·7	58·2	50·71
Approximate mean temperature of the air	—	63·59	65·35		—	50·3	51·6	53·6	54·4	57·6	59·9	63·4		-
Mean maximum temperature in the sun			-	-		- -	—		-				—	
Mean minimum temperature on the grass		56·48	55·7	48·6	46·2	39·0	42·1	41·3	44·7	47·0	49·6	51·1	55·8	48·13
Mean maximum temperature of evaporation	-	65·2	—					-		-	-	—		—
Mean minimum temperature of evaporation	- -	57·0	54·9	50·1	49·1	43·4	43·8	43·7	46·3	48·6	50·5	52·5	57·1	49·75
Quantity of rain in each month, on the ground		4·98	7·84	5·57	4·30	5·67	4·94	2·51	6·94	1·93	2·25	1·50	·16	Total. 48·12
Quantity of rain in each month, 30 feet above the ground		3·50	5·31	4·52	2·34	3·70	3·59	1·29	4·61	1·04	1·30	·75	·02	31·77
Greatest quantity of rain in 24 hours	—	1·42, Date 19	3·11, Date 4	2·30, Date 21	0·60, Date 15	1·24, Date 19	0·57, Date 16	1·00, Date 20	0·85, Date 19	0·58, Date 11	0·60, Date 11	0·14, Date 26	·08, Date 22	For the year March 3·16, 4

Wind.		Number of Days from each Point, and Number of Days on which there was Rain.																								Total.	
	Direction.	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on	No.	Rain on
Direction at 9.30 a.m.	N.	3	2	1	-	-	-	2	2	-	-	1	1	-	-	1	-	4	2	1	1	-	-	-	-	13	8
	N.E.	1	1	4	3	1	1	1	1	4	3	4	3	3	3	3	2	5	4	2	1	7	-	7	1	45	26
	E.	2	2	4	1	-	-	1	1	-	-	2	2	1	1	1	-	2	1	1	-	1	-	1	-	19	8
	S.E.	1	-	4	4	7	6	2	1	6	1	1	1	14	1	1	1	-	-	-	-	4	-	3	-	43	15
	S.	1	-	3	1	3	-	1	-	3	1	3	1	2	-	1	-	5	1	1	-	5	1	8	-	36	5
	S.W.	8	3	8	3	6	1	13	6	8	5	8	4	3	3	3	2	9	5	14	4	12	4	11	1	105	41
	W.	3	1	5	4	6	5	7	5	6	6	2	2	2	2	9	7	4	-	7	5	-	-	1	1	52	38
	N.W.	9	5	2	2	4	3	4	4	3	3	7	7	3	3	11	11	2	1	4	2	5	3	-	-	54	44
Direction at 3.30 p.m.	N.	—		—		—		—		1		—		—		1		2		2		1		—		7	
	N.E.	5		5		4		4		3		6		8		2		6		3		9		11		66	
	E.	1		5		2		1		2		4		4		—		—		1		4		1		25	
	S.E.	1		1		5		—		5		2		10		1		—		—		1		—		26	
	S.	2		4		—		1		3		—		3		2		4		4		—		6		29	
	S.W.	8		8		8		14		9		9		3		3		9		12		10		12		105	
	W.	2		4		2		4		4		1		2		6		4		3		—		1		36	
	N.W.	9		4		9		7		3		6		1		15		6		5		5		—		70	
	—	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	—	Date.	-	Date.	—	Date.	Max. and Min. for the Year.	
Maximum height of barometer (observed)	9.30 a.m.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30·370	7	30·221	4	-	-	-	-
	3.30 p.m.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30·681	11	-	-		-	30·298	12	-	-
Minimum height of barometer (observed)	9.30 a.m.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29·885	10	-	-
	3.30 p.m.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29·538	7	29·716	20	29·637	26	-		-	-
Extreme range of barometer (observed)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1·143	-	0·654	-	0.589		0·413	-	-	-
Maximum temperature of the air	-	-	-	78·4	15	-	-	-	-	63·0	2	66.8	16	67·2	18	69·5	3	73·7	31	77·0	8	83·7	7	-	-	-	
Minimum temperature of the air	-	52·8	13	47·0	31	45·3	4	40·1	13	35·0	27	35·0	27	37·8	15	36·0	1	41·0	10	46·0	27	46·0	21	50.5	11	35·0	July 27
Extreme range of temperature	-	-	-	31·1	-	-	-	-	-	28·0	-	31·8	-	29·4	-	33·5	-	32·7	-	31·0	-	37·7		-	-	-	-
	1853-	February.		March.		April.		May.		June.		July.		August.		Sept.		October.		Nov.		Dec.		January		1854.	

OBSERVATIONS made by Lieutenant Chesney, R.E., and Messrs Mathews, Mahoney, and Warner, C.W., under the direction of Lieut.-Colonel Bolton, R.E., Commanding Royal Engineers.

Auckland, New Zealand.

Latitude 36° 50′ 5″ S. Longitude 174° 50′ 40″ E. Height above the sea 125 feet.

Remarks.

1853 :

April.—Hooping cough prevalent among children.

May.—Hooping cough still prevalent, but upon the decrease; but many children have died from it. Coughs and colds general.

June.—Hooping cough still prevalent. The morning of Tuesday, the 30th, was colder than any before experienced in Auckland A partial eclipse of the moon on the 21st, at 7 p.m.

July.—Hooping cough still prevalent. Three parts of this month has been very disagreeable, and cloudy, with passing showers and squalls.

August.—Colds have been prevalent during this month, but hooping cough has nearly disappeared. The weather has been very fine, but cold in the morning and evening.

September.—Influenza and colds prevalent. The weather has been unusually rainy and boisterous this month. A comet seen on the 14th.

November.—Colds and catarrh prevalent this month.

December.—A few cases of slight fever during the month. The weather has been very pleasant throughout.

1854 :

January.—The weather during this month has been very warm—sometimes oppressively so—though the sky has generally been clear. This summer has been the driest and warmest experienced since 1846. Boils on different parts of the body were prevalent during the month.

VII. BRIEF DISCUSSION OF SOME OF THE PRINCIPAL RESULTS OF THE OBSERVATIONS.

In attempting to draw any general conclusions as to the laws which govern the circulation of the atmosphere from the observations taken at the engineer stations only, we are forcibly reminded of the necessity of combination amongst meteorologists to obtain sufficient data for such investigations; for although our stations are widely spread over portions of the globe, they are neither sufficiently numerous, nor the observations at the stations sufficiently frequently taken, to enable us to treat numerous highly interesting problems in meteorology with the precision they require. With such imperfect data, however, as we have, we may discuss some of the more marked phenomena, and this rather with the view of drawing the attention of the officers of engineers to the nature of the investigations for which we require data, than in the hope that we can satisfactorily investigate the problems before us.

1. *Atmospheric Waves.*

In the "Instructions for taking Meteorological Observations" which were issued to the officers they were requested to send, with the monthly registers, diagrams representing the pressure of the atmosphere, the temperature, amount of rain, &c., so that any remarkable circumstance might be seen by a mere inspection of the diagrams, for the fuller explanation of which we could then refer to the registers.

In examining the diagrams of atmospheric pressure for the month of January last we were forcibly struck, not only with the great variation in the amount of pressure from day to day at nearly all the stations in the northern hemisphere, but with the remarkable general correspondence in the curves at equal intervals of time through portions of the month, which clearly indicates the passage of a series of atmospheric waves over these stations.

These curves are represented in the diagram of atmospheric pressure, plate II.

In examining the diagram for Kingston, Quebec, Halifax, and Newfoundland, and that for Washington, for which I am indebted to Lieut. Maury, we find that the great depression which occurred at Kingston on the 12th, at 3.30 p.m., occurred at Washington six hours later, and at Quebec at 3.30 p.m. on the 13th, reaching Newfoundland at 3.30 p.m. on the 14th, from which it would appear that several atmospheric waves, two of which are included between the lines E, F, E', F', plate II., passed over this portion of North America in a south-east direction, as shown in plate I.

Again, if we examine the diagrams for Dublin, Edinburgh, Guernsey, Southampton, and Chatham, we find that the great depression which took place at 9.30 a.m. on the 24th, at Edinburgh and Dublin, was observed at Guernsey, Southampton, and Chatham at 3.30 p.m. on the same day, and from the diagram for Brussels, for which I am indebted to M. Quetelet, we see that the same depression took place there at 9.30 p.m. on the same day, and there is so remarkable a correspondence in the curves at all these stations, and particularly in that portion included between B and D on the Dublin diagram, that we are again led to conclude that a series of atmospheric waves passed over the United Kingdom in a south-east direction, as shown in plate I. It will also be observed that this direction corresponds with the direction of the waves traced by M. Quetelet in June 1851, which are represented on the same plate.

In comparing the diagram for Newfoundland and Dublin, between the lines A, B, C, D, we are again struck with the correspondence in the curves of these stations, though they are 2,000 miles apart. The intervals of time in this case vary from one to three days. We have not sufficent data to justify us in drawing lines with such inflections as would connect the atmospheric waves which passed over the United Kingdom with those which passed over our North-American stations, but we see by the inflections of the waves, which M. Quetelet has traced, that it is very possible that the same waves passed over all these stations, and that the inflections in them were not greater than those which are represented on plate I.

Lieutenant Maury has kindly undertaken to examine the log-books of vessels which traversed the Atlantic in January, in the hope that they will supply the requisite data for tracing the course of these waves; and here we see how important it is for the meteorologists on land to co-operate with those at sea, to enable us to follow out with any degree of satisfaction such investigations as these.

The fluctuations in the height of the barometer in the lower latitudes is comparatively so small that we do not so readily perceive the differences or correspondence of the curves of barometric pressure, but an examination of the curves for Gibraltar, Malta, and Corfu seems to show that during the month of January atmospheric waves traversed the Mediterranean in N.N.W. direction, as shown in the diagram, plate II., and on the map, plate I.

There are few phenomena more remarkable than the passage of atmospheric waves over the surface of the earth, and when their courses and their extent are fully investigated by the joint labours of meteorologists in all parts of the world, they will probably afford us more precise data for tracing the circulation of the air in the higher regions of the atmosphere than any other. In the lower regions of the atmosphere they have the effect of constantly changing the direction of the wind from their apexes towards their troughs,

and this is accompanied with a compression of the air and an evolution of heat under the pressure of the full wave, and an expansion of the air and a diminution of heat in the troughs; these effects again lead to others in that great chain which links together all meteorological phenomena.

2. *Mean Diurnal Oscillation of the Barometer in different parts of the Globe.*

Professor James Forbes has given the following equation for the mean oscillation of the barometer :—*

> $Z = \cdot 1193$ cosine $\frac{3}{2}\phi - \cdot 015$ for inches—Z being the oscillation in latitude ϕ—this gives for the equatorial oscillation $\cdot 1043$ inch, and for the poles $- \cdot 015$ inch. The latitude where the oscillation changes its sign, or is $= 0$ is $64^\circ\ 8'\ 6.''$

The correspondence between the observed and the calculated oscillations is very remarkable, and proves,— as the distinguished philosopher to whom we are indebted for this formula has himself said,—that the change in the order of recurrence of the daily maxima and minima in the higher latitudes might have been deduced from theory before it was observed by Sir Edward Parry; beyond the latitude of 64° the mean barometric height is greater at 4 p.m. than at 10 a.m., the reverse of what takes place in latitudes below 64°.

The following table shows the comparison between the *observed* mean oscillations at the different stations and the computed oscillations from the above formula, but we do not know that the entire range of the oscillations is obtained from the $9\frac{1}{2}$ a.m., and $3\frac{1}{2}$ p.m. observations :—

Names of Stations.	Latitude. °	′	Oscillation from $9\frac{1}{2}$ A.M. to $3\frac{1}{2}$ P.M.	Computed Oscillation.	Difference.
Edinburgh	55	58	0·014	0·013	0·001
Guernsey	49	33	0·023	0·025	0·002
Newfoundland	47	35	0·023	0·029	0·006
Quebec	46	48	0·049	0·031	0·018
Corfu	39	37	0·034	0·047	0·013
Gibraltar	36	6	0·041	0·055	0·014
Malta	35	54	0·038	0·055	0·017
Hong Kong	22	16	0·085	0·083	0·002
Jamaica	17	59	0·064	0·090	0·026
Barbadoes	13	4	0·046	0·096	0·050
Ceylon	6	56	0·104	0·102	0·002
Mauritius	20	10	0·067	0·086	0·019
Fremantle	32	15	0·041	0·063	0·022

Sir Edward Parry, whilst at Port Bowen, in latitude 73° 48′, found the oscillation to be 0·009, calculated by the formula it is 0·010.

* Report on Meteorology by Professor James Forbes. British Association, 1832, and Edinburgh Journal of Science, 1832.

Professor Espy, in his second report on the Meteorology of the United States, gives the following explanation of the causes which produce the horary variations of the barometer :--

" Besides the fluctuations of the barometer depending upon storms, there " are four daily fluctuations produced entirely by the increasing and diminish- " ing elasticity of the air, due to increasing and diminishing temperature. " When the sun rises the air begins to expand by heat ; this expansion of the " air, especially of that near the surface of the earth, lifts the strata of air " above, which produces a reaction, causing the barometer to rise ; and the " greatest rise of the barometer takes place when the increase of heat in the " lower parts of the atmosphere is the most rapid—that is, about 9 or 10 a.m. " The barometer from that time begins to fall ; and at the moment of maxi- " mum heat, when the air is neither expanding nor contracting, the barometer " indicates the exact weight of the atmosphere. The barometer, however, " continues to descend, on account of the diminishing tension of the air and " consequent sinking upon itself, as the evening advances, and its greatest " depression is at the moment of the most rapid acceleration of diminution of " temperature, which is about 4 or 5 p.m. At this moment the barometer " indicates a less pressure than the true weight of the atmosphere. The " whole upper parts of the atmosphere have now acquired a momentum " downwards, which, as the motion diminishes, causes the barometer to rise " above the mean ; this takes place at the moment when the diminution of " the motion downwards is the most rapid. This maximum of rise, which " takes place about 10 p.m., is small when compared with that at 9 or 10 a.m. " As the barometer now stands above the mean, it must necessarily descend " to a mean at the moment when the air is neither increasing not diminishing " in temperature, which is just before sunrise. If this is the true explana- " tion of the four daily fluctuations of the barometer, it will follow that the " morning rise ought to be greater at considerable elevations on mountains, " provided they are not too great, because some of the air will be lifted " above the place of observation by the expansion below. And this deduc- " tion agrees well with the observations of Colonel Sykes in India ; he " found the nocturnal falling minimum fluctuation from 10 or 11 p.m. to 4 or " 5 a.m. to be ·0181 inch at Poonah, about 1,800 or 2,000 feet high, and the " diurnal rising fluctuation from 4 or 5 a.m. to 9 or 10 a.m. to be ·0445 inch ; " and at the height of 4,500 feet he gives these same fluctuations, ·0240 and " ·0636 inch ; and at the height of 6,407 feet, ·0433 and ·0490, as observed by " Dr. Walker and M. Dalmahoy. (Royal Phil. Trans. for 1835, page 196.) " At very great elevations it is probable that there would be only two fluc- " tuations in a day—the maximum near the time of the greatest heat, and " the minimum near the time of the greatest cold of the air. At moderate

" elevations, such as four or five thousand feet, the effect is to prolong the " morning maximum at the upper station, so that it continues to rise there " for some time after it has begun to descend at the lower station. Obser- " vations are wanting to determine this last deduction of theory."

" (Since writing the above I have seen Captain Wilks's observations on a " mountain in one of the Sandwich Islands, upwards of 13,000 feet high, " where, from his tables, it appears that the barometer had but two fluctua- " tions in the twenty-four hours—the minimum early in the morning, and the " maximum towards three o'clock in the evening; and this was the only point " in my theory which needed confirmation when the theory was proposed.)"

" The principle here assigned as a vera causa is too plain to admit of " doubt. It is the mere application of the law that 'action and reaction are " equal and in opposite directions.' It may, however, be illustrated in the " following manner:—Let a person balance himself in a pair of large scales, " in a stooping position: if he raises himself his scale descends, and when he " is erect equilibrium is restored; in stooping down his scale ascends as " soon as his downwards motion commences, and when his velocity down- " wards begins to diminish his scale descends below equilibrium; and when " he comes to rest equilibrium is again restored: thus four oscillations of the " scales will be produced by one upward and downward motion of his " body, corresponding to one expansion and one contraction of the air in a " day by heat and cold."

Horary Variations of the Barometer.

We have not as yet received a sufficient number of hourly observations properly to discuss this subject.

The means of the hourly observations taken at two of the intertropical stations are given in the following table, and are represented in the diagram plate V.:—

Stations.	Mean Height of the Barometer.											
	P.M.											
	Noon.	1	2	3	4	5	6	7	8	9	10	11
Mauritius	29·936	29·909	29·894	29·887	29·882	29·888	29·901	29·914	29·926	29·939	29·944	29·936
Ceylon	29·915	29·888	29·870	29·847	29·844	29·848	29·864	29·889	29·906	29·918	29·924	29·923

A.M.												Approximate Mean.	Remarks.
Mid-night.	1	2	3	4	5	6	7	8	9	10	11		
29·930	29·918	29·907	29·902	29·896	29·901	29·922	29·933	29·943	29·946	29·949	29·939	29·918	Mean of 24 Observations.
29·909	29·889	29·880	29·874	29·875	29·883	29·910	29·915	29·932	29·945	29·947	29·954	29·895	Mean of 7 Observations.

At the *Mauritius* and *Ceylon* the march of the barometer appears to be very regular throughout the day, and to attain its greatest height at about 10 a.m. and its least height at about 4 p.m., its second maximum at about 10 p.m., and its second minimum at about 4 a.m. At the *Mauritius* the mean of the maximum and minimum = 29·916, and the mean of the twenty-four hours = 29·918. At *Ceylon* the mean of the maximum and minimum = 29·895, and the mean of the twenty-four hours is also 29·895; and we may conclude that at the intertropical stations the mean of the maximum and minimum height of the barometer is very approximately equal to the mean of the twenty-four hours. Lieut. Fyers, R.E., has taken half-hourly observations at the Mauritius, and from these it appears that the maximum and minimum occur at 9½ a.m. and at 3½ p.m.; that is, at those hours at which the daily observations are taken at all the stations.

We may also infer from these observations, that within the tropics the barometer attains its mean height at about a quarter before one o'clock, p.m.

In comparing the barometric with the thermometric curve at the Mauritius, see plate V., we see that, whilst the temperature gradually increases from its minimum between 4 and 5 o'clock a.m. to its maximum between 1 and 2 o'clock p.m., and again gradually descends to its minimum, showing but one well defined maximum, and one minimum, the barometric curve, on the contrary, shows, as before described, two well defined maxima and minima. We also see that the first maximum of the barometer takes place whilst the temperature is increasing, and that the second maximum occurs when the temperature is decreasing.

Variation in the Mean Height of the Barometer with the Latitude.

M. Kaemtz gives the following as the results of the observations made by Erman, Herschell, Schouw, Muncke, and Poggendorff:—

		Inches.
The mean height of the barometer at the level of the sea	=	29·974
At the equator about - - - -	=	29·842
At the latitude of 10° the pressure increases, and between the 30th and 40th degrees it attains its maximum -	=	29·999 or 30·076
From this zone it diminishes, and about the 5th degree	=	29·921
And in the more northern countries descends to about	=	29·763

Sir John Herschell, in his voyage to the Cape of Good Hope, confirmed the previous observations of M. Erman, and found that from the 60th parallel the mean pressure increased to the 25th; that is, to about the limits of the trade-winds, and from this parallel it regularly decreases to the equator

From the 25th towards the poles the diminution is much more rapid than in the zone of the trade-winds.

But it has been shown that the isobarometric lines do not follow the lines of the parallels of latitude, and that in equal latitudes the mean height of the barometer is ·137 inch greater on the Atlantic Ocean than on the Pacific.

3. *Variation of the Mean Temperature with the Latitude.*

Sir David Brewster has given the following simple formula for computing the approximate mean temperature of any place:—

$$t = 81^\circ\cdot5 \text{ Cosine L};$$

t = the mean temperature, 81°·5 the assumed mean temperature at the equator, and L the latitude. The course of the isothermal lines, as they have been traced by Humboldt and Dove, shows that this formula can only be approximately true; but, taking the mean temperature as obtained approximately from the mean of the maximum and minimum temperature at our stations, and adding 1° for 250 feet of altitude above the level of the sea, we have the following result:—

Stations.	Latitude.	Mean Temperature.		
		Observed.	Calculated.	Difference.
	° ′			
Edinburgh - - -	55 58	47°·1	46°·1	− 1°·0
Hong Kong - - -	22 16	74 ·6	75 ·4	+ 0 ·8
Jamaica - - -	17 59	79 ·4	78 ·5	− 0 ·9
Ceylon - - - -	6 56	80 ·4	80 ·8	+ 0 ·4
Mauritius - - -	20 9	77 ·4	76 ·5	− 0 ·9

The configuration of the ground in the neighbourhood of stations at which observations on the temperature of the air are taken will obviously affect the results. In protracting the diagram of the mean hourly temperature at Jamaica I was much struck with the sudden rise of the thermometer at a certain hour there, and I referred the question to Colonel Yule, R.E., under whom the observations were taken, and at the same time sent a sketch of such a configuration of the ground in the neighbourhood as I thought would produce the anomaly. The following is the reply:—“Your diagram, which “I return, happens to be a very good section of the actual form of Long “Mountain, which is nearly 3,000 yards from the barracks at Up Park.”

This is rather a curious fact, but I do not recommend my brother officers to attempt to sketch ground from thermometric observations!

4. *Fall of Rain at the Royal Observatory, Greenwich.*

Taking December, January, and February as the winter months; March, April, and May as the spring months; June, July, and August as the summer months; September, October, and November as the autumn months, the quantities which fell in the different seasons were as follows:—

	1842.	1843.	1844.	1845.	1846.	1847.	Mean.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Winter - - -	2·81	4·14	5·16	5·33	5·42	4·77	4·60
Spring - - -	4·42	5·98	3·59	4·27	5·43	3·16	4·47
Summer - - -	5·69	7·34	6·63	6·84	6·00	4·12	6·10
Autumn - - -	9·65	7·01	9·58	5·90	8·44	5·56	7·69
Total - -	22·57	24·47	24.96	22·34	25·29	17·61	22·86

The quantity of rain which fell at the Royal Engineer stations during the year 1853–4, was as follows:—

	Inches.		Inches.
Edinburgh - - -	40·70	Barbadoes - - -	68·24
Guernsey - - -	32·77	Ceylon - - - -	71·63
St. Johns - - -	55·05	Mauritius - - -	39·52
Gibraltar - - -	47·29	Fremantle - - -	33·94
Malta - - -	28·08	New Zealand - - -	48·42
Jamaica - - -	34·31		

The district of Cutch, at the mouth of the Indus, is all but a rainless district; but in the Khassya hills, north of Calcutta, the annual fall amounts to 600 inches or 50 feet, eleven-twelfths of which descend in the six rainy months; Professor Oldham measured a fall of 25·5 inches in one day.

From experiments made by Dr. Heberdeen at Westminster Abbey in 1776; by Professor J. Phillips at York Minster in the years 1832, 3, 4, and 5; by Mr. Littledale in 1834–5 at Bolton Church, Yorkshire; by Mr. J. F. Miller in the years 1844, 5, 6, 7, at St. James's Church, Whitehaven; by Dr. Buist in the years 1843–4, at the Bombay Observatory, and from the observations made at the Royal Observatory at Greenwich, the fact is clearly established that in the lower regions of the atmosphere, the quantity of rain which falls diminishes with the altitude above the ground.

The following results were obtained from the observations at Greenwich:

	1842.	1843.	1844.
	Inches.	Inches.	Inches.
Anemometer gauge 50 feet above the ground -	12·63	14·88	14·62
Library gauge 24 feet above the ground -	20·03	22·12	22·19
Crosley's gauge 1 foot 11 inches above the ground	21·44	22·53	21·28
Cylindrical gauge 5½ inches above the ground -	22·57	24·47	23·20

The results obtained at the Royal Engineer stations are in general in accordance with those obtained in the country, and are exhibited in the following table:—

		Inches.
St. John's, Newfoundland	20 feet above the ground	40·06
	On the ground	55·05
Gibraltar	25 feet above the ground	46·25
	On the ground	47·29
Malta	20 feet above the ground	24·44
	On the ground	28·07
Jamaica	40 feet above the ground	25·88
	On the ground	34·31
Barbadoes	20 feet above the ground	59·13
	On the ground	68·24
Ceylon	23 feet above the ground	69·29
	On the ground	71·63
Mauritius	28 feet above the ground	34·33
	On the ground	39·52
New Zealand	30 feet above the ground	31·77
	On the ground	48·42

The Guernsey observations are not in accordance with the above, but the disagreement at this station is probably owing to the position of the gauges not being well selected.

The cause of the increased quantity of the rain at the lower levels may be explained by supposing that as the cold drops of rain descend through the moist atmosphere, they continue to condense moisture on themselves and to increase in bulk and quantity, the further they are allowed to proceed in their descent.

The experiments of Mr. Miller in the mountainous lake district of Cumberland and Westmoreland, described by that gentleman in the Philosophical Transactions for 1849, and the results obtained in India, which are so ably discussed by Lieutenant Colonel Sykes in the Philosophical Transactions for 1850, prove that in mountainous districts, the quantity of rain which falls at stations at different altitudes, increases with the altitude of the station up to a certain height, and then again diminishes; this height was found in the Lake district to be at about the height of 2000 feet, and in India at an altitude of 4,500 feet above the level of the sea.

The following table is taken from Mr. Miller's paper:—

	Altitude above level of the Sea.	Inches.
The Valley	160 feet.	170·55
Stye Head	1,290 „	185·74
Seatoller Common	1,334 „	180·23
Sparkling Tarn	1,900 „	207·91
Great Gable	2,925 „	136·98
Sea Fell	3,166 „	128·15

The following is taken from Lieutenant Colonel Sykes's paper:

	Inches.
Mean at seven stations at sea level - - -	81·70
At 150 feet—Rutnagherry - - - -	114·55
At 900 feet—Dapoole - - - - -	134·96
At 1,740 feet—Kundalta - - -	141·59
At 4,500 feet—Mahabuleshwur - - -	254·05 } +
At 4,500 feet—Mercara - - - -	143·36 } +
At 4,500 feet—Uttray Mulluy - - -	263·21 } +
At 6,100 feet—Kotugherry - - - -	81·71
At 8,640 feet—Dodabetta - - - -	101·24

In explanation of this phenomenon Mr. Miller observes, "the warm south-
" westerly current arrives at the coast loaded with moisture obtained in its
" transit across the Atlantic; now our experiments justify us in concluding
" that this current has its maximum density at about 2,000 feet above the
" level of the sea: hence it will travel onward till it is obstructed by land of
" sufficient elevation to precipitate its vapour; and retaining a portion of the
" velocity of the lower parallel of latitude, whence it was originally set in
" motion, it rapidly traverses the short space of level country, and with little
" diminution of its weight or volume; but on reaching the mountains it
" meets with a temperature many degrees lower than the point at which it
" can continue in a state of vapour sudden condensation consequently
" ensues in the form of a vast torrent of rain, which in some instances must
" descend almost in a continuous sheet, as when nine or ten inches are pre-
" cipitated in forty-eight hours."

Lieut.-Colonel Sykes says "the explanation of the prodigious fall of rain
" at the level of 4,500 feet is simple and satisfactory. The chief stratum of
" aqueous vapour brought from the equator by the S.W. monsoon is of a
" high temperature, and floats at a lower level than 4,500 feet, indeed I have
" looked over or upon the surface of the stratum at 2,000 feet. It is dashed
" with considerable violence against the western mural faces of the Gháts, and
" is thrown up by these barriers in accumulated masses into a colder region
" than that in which it naturally floats: it is consequently rapidly condensed,
" and rain falls in floods."

5. *Results of Experiments upon the Dissolution of Ice and Snow at Kingston, C. W., 28th February 1854.*

Cubic Content of Snow or Ice.	Weight.	Description or Character of Snow or Ice.	Temperature under which Dissolution took place.	Quantity of Water yielded.	Remarks.
Snow. 1 foot cube -	lbs. oz. 14 14	As it fell - - - -	52	·16 Cubic foot.	The whole of the experiments were conducted with great care and exactness.
1 „ -	21 4	24 hours after falling; subsequent average, atmospheric temperature 8°	52	·31 „	*Present.* Lt.-Col. GORDON, Lieut. FARRELL, „ the Hon. J. BURY „ COX, } Royal Engineers.
1 „ -	28 10	72 hours after falling; average temperature 30°	52	·33 „	
Ice. 1 foot cube -	57 0	Average temperature Zero.	52	$\frac{7}{8}$, or 1512 cubic inches, or 54lbs. weight of water.	So pure and transparent was the ice, that manuscript was perfectly legible through it.

ALEXANDER GORDON, Lieut.-Colonel Royal Engineers.

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6. *Wind.*

The numbers in the Table show what are the prevalent winds at the different stations during each month, and during the year; they also show the direction in which the wind generally changes in the afternoon, and also those winds which bring the rain.

Thus, at Colombo, the number of days on which the wind blew during the year from the S.W. was 113, whilst the largest number in any other direction was 55, from the N.E.

Again, the wind blew 12 days from the N.W. in the morning, but it blew 70 days from that quarter in the evening; whilst it only blew 15 days in the afternoon from the N.E., instead of 55 from that quarter in the morning, clearly showing the tendency to changes from the N.E. to the N.W. during the afternoon. The periods during which the N.E. and S.W. monsoons lasted are also seen by the table. In May, during the period of the S.W. monsoon, the wind only blew one day in the morning in any other direction than S.W., and during this month the fall of rain was 25·45 inches.

7. *Description and Remarks on the Gale which took place in the Bahama Islands, between the 10th and the 23d November 1853, to accompany Meteorological Observations taken during the period of its passing over the Island of New Providence, on the night of the 22d November 1853.*

The accompanying plan* of the Bahama Islands has been constructed in order to show the geographical position of certain vessels which experienced

* This has not been engraved.

the late gale, in the month of November 1853, as well as to mark the track of the hurricane which occurred about that period.

Owing to the prevalence of strong north winds about this time of the year it has been found excessively difficult to define the exact limits of this hurricane; but from the inclosed statements it may be inferred, that on the 18th November the west end of the island of St. Domingo was visited by a severe gale of a rotatory character, which proceeded in a northerly direction, increasing in violence as it advanced, and in all instances revolving from east to south and south-west.

From thence it proceeded in the direction of the Bahama Islands, and arrived on the 20th of November at the island of Magua, where its greatest force was felt on that day. From a letter by an inhabitant,—" it is stated as " being the most severe hurricane ever felt;" and in another letter,—" We " have been visited by the most severe hurricane ever felt; all the salt has " been washed away, vessels driven on shore, and the entire vegetation of " the island destroyed."

We next trace it, on the 21st of November, to the island of Rum Cay, where it seems to have been felt most severely, great damage being done to houses, salt ponds, and every description of vessel.

Long Island, nearly adjacent, seems to have suffered nearly as severely.

It next seems to have taken a westerly direction, and to have expended its force a little beyond the island of New Providence, no traces being discernible beyond this of more than ordinary tempestuous weather.

This data has been collected from captains of ships, their logs, and from letters by persons living in the various Bahama Islands.

Barometric observations have in some instances been supplied, but, owing to errors in local barometers and want of any sort of regularity as to time or date in taking these observations, little dependence can be placed on their accuracy.

However, it appears evident that the barometer fell suddenly and in some instances excessively low; for, by the statement of the royal mail steamer "Esk," on her passage from Nassau to St Thomas's, when about 40 miles to the north of Watlin Island, on the 21st of November, " it was remarked that " the mercury fell almost by inches as low as 27·10, and oscillated excessively " during the time the vessel was under the influence of the hurricane."

At Nassau, where hourly observations were made, the barometer fell but slightly, and with a much more gradual force, but the mercury oscillated as above described.

E. N. Heygate,
Lieut., Royal Engineers.

December 10, 1853.

RECORD.

EXTRACTS from LOGS of VESSELS exposed to the GALE which occurred between the 10th and the 26th November 1853, to accompany Hourly Meteorological Observations taken on the 22d and 23d November, at Nassau, Bahamas.

Name of Vessel.	Lat.	Long.	Date.	Remarks.
No. 1. Schooner "Urania," from Charleston, S.C. to Tampa Bay.	30 30	- -	20th Nov.	Wind east, with cloudy weather.
	27 57	- -	21st „	Wind very heavy, squally, N.E.
			22d „	Ditto ditto wind increased, with irregular cross sea. Struck 11 p.m. Cheroker Sound. "Abaco."
No. 2. Brig "Gustavus," from Port-au-Prince, to Boston.	26 15	73	22d „	Very heavy gale from N.E., and encountered an irregular heavy cross sea. In consequence of the death of the captain, and sickness of the crew by yellow fever, no log was
	21 30	73 40	23d „	kept till she was picked up by wreckers near Hogstye Reef, having drifted nearly 260 miles before a northerly gale in five days.
No. 3. Brig "Jouvin Sancha," from Havanna to Santandar, Spain.	31 23	61 25	24th „	From the 7th to 24th, encountered severe north gales, when the wind increased so as to oblige the ship to lay-to. The wind came in squalls, with a heavy irregular
			25th „	cross sea. The ship was at last thrown on her beam ends, and when righted she ran for Nassau.
No. 4. Brig "James," from Belize to London.	27 10	- -	21st „	Heavy N.E. gales up to this time, when the wind increased and became tempestuous, with a heavy cross sea; ship under double-reefed mainsail.
			22d „	4 a.m., topsail split. Wind rather more easterly, blowing a hurricane.
			24th „	Nothing then occurred till the 24th, when the wind ceased for a short time but increased at night, with squalls of rain, lightning, and high cross sea, from the N.N.E.
			25th „	The wind still in a northerly direc-
			26th „	tion, and nearly as bad. The cargo having shifted, and being in a leaky state, the ship was put for Nassau, where she was wrecked on the bar of the harbour, and went to pieces. Log lost.

Name of Vessel.	Lat.		Long.		Date.		Remarks.
No. 5. Brig "Pechaza," from New York to Nassau.	36	50	-	-	18th	Nov.	Sailed for New York on Nov. 15th. Heavy cross sea from the N.E., and a strong current setting to the E.
	37		-	-	19th	..	Calm, with a heavy sea, W. by N.
	34	42	71	40	23d	..	Calm till the 23rd, but heavy sea and swell at night. Wind E.S.E. Flying clouds from the N.E.
	31	22	-	-	24th	..	The wind fresh from E.N.E. Thick weather, with rain. This continued till the 27th, when they reached he port of Nassau.
No. 6. Island of Rum Cay.	-	-	-	-	-	-	This island was visited on the evening of the 21st of November by a most terrific hurricane, which continued to blow with more or less violence till the morning of the 23rd. During the gale great damage was done to the island, many houses being blown down, the salt washed away, and the crops were so destroyed as to cause almost starvation to the inhabitants, and every vessel near was either wrecked or sunk. The wind shifted from every quarter, and the barometer was extremely low.
No. 7. Long Island.	-	-	-	-	21st to 23d	..	This island, nearly adjacent, suffered almost as severely, eleven island vessels being wrecked, and many lives lost. The wind commenced to blow first from the N.E., and ended in the S.W. The sea rose to a distance of 30ft. above the usual high-water mark.
No. 8. Island of Magua.	-	-	-	-	20th	..	At this island the wind first blew hard from the S.W., and increased in a short time into a most terrific hurricane, increasing till the morning of the 21st, with quantities of rain, and described as being the severest hurricane ever experienced.
No. 9. The Island of St. Domingo, Port Genius.	-	-	-	-	19th	..	On this day a hurricane was distinctly felt on the west end of this island. The wind was first from the E., and afterwards went into the S.

Name of Vessels.	Lat.	Long.	Date.	Remarks.
No. 10. Brig "Eagle," from Port Genius to America.	° ' - -	° ' - -	19th Nov.	Left port on the 19th; did not feel much wind till clear of Cape Nicolanola. On the 20th, met a heavy gale, cross sea from the N. Wind in squalls and rain from the N. When 20 miles from S. of Magua. bore E. and cleared the gale. Barometer 29·2. When clear of the Bahama Islands steered nearly W.N.W. and followed for six days in track of hurricane.
No. 11. Royal Mail Steamer "Esk," from Nassau to St. Thomas.	- -	- -	21st "	Sailed from Nassau November 14; when 60 miles to the N. of Watlin Island, on the 21st November, found that the wind, which had been blowing heavily from the N. for some time, increased to a hurricane from the N.E., with a tremendous high cross sea. The barometer fell suddenly from 30· to ·29, and then to 27·10.
			22d "	On this day the barometer rose to 28·10, and then to 29·6, the wind changed to S.W., and greatly decreased. It rained before and after the hurricane, but not at the time.

8. *Peculiar effects of the East Wind at Gibraltar.*

I am indebted to Major General Harding for the following note:

"At Gibraltar, where the east wind coming down the Mediterranean is a moist wind, it seems to have some effect upon oils not easily to be accounted for. If oil paint be laid on during a continuance of this wind, it will not harden, but remain soft and sticky, or adhesive, to everything laid upon it, and retains this quality for one or two years on a recurrence of easterly wind, even though apparently dry when the wind is west. It is commonly observed that meat will not keep during an east wind, I suppose from its action on the fatty parts. In illustration of its effects on oils, I may mention the little experiment of floating a divided leaf of the terebinthus tree: when the wind is westerly the oil from the pores of the leaves comes out in jets, and causes the parts of the leaf to move about as if of its own will, but in an east wind the oil comes out so liquid that it floats on the top of the water, but the leaf

is motionless. The east wind has a great many other faults laid to its charge, but I give you these only as facts quite ascertained and visible."

The other faults to which General Harding refers have been celebrated by the Hon. Mrs. George Wrottesley in the following stanzas :—

"'TIS AN ILL WIND THAT BLOWS NOBODY GOOD."

"You have all heard of far-famed Gibraltar,
'Tis a wonderful place, each one says:
I admire it myself, and don't falter
In adding my poor word of praise;
But take this advice, and don't quiz it,
If you value your comfort the least,
Do not fix on a time for your visit
When the wind is inclined to the East.
Aie! Aie! Aie! Aie! Aie! Aie! what a pity
That an east wind should spoil such a city!

"When in mist every object is shrouded,
When the women complain, when men swear,
When each face that you meet with is clouded,
The wind's east you may safely declare.
Blowing rocks up I own's a fine notion,
But the blasts of the rock, you will find,
Do not raise here half such a commotion
As a blast of the easterly wind.
Aie! Aie! Aie! Aie! Aie! Aie! what a pity
That a wind should affect such a city!

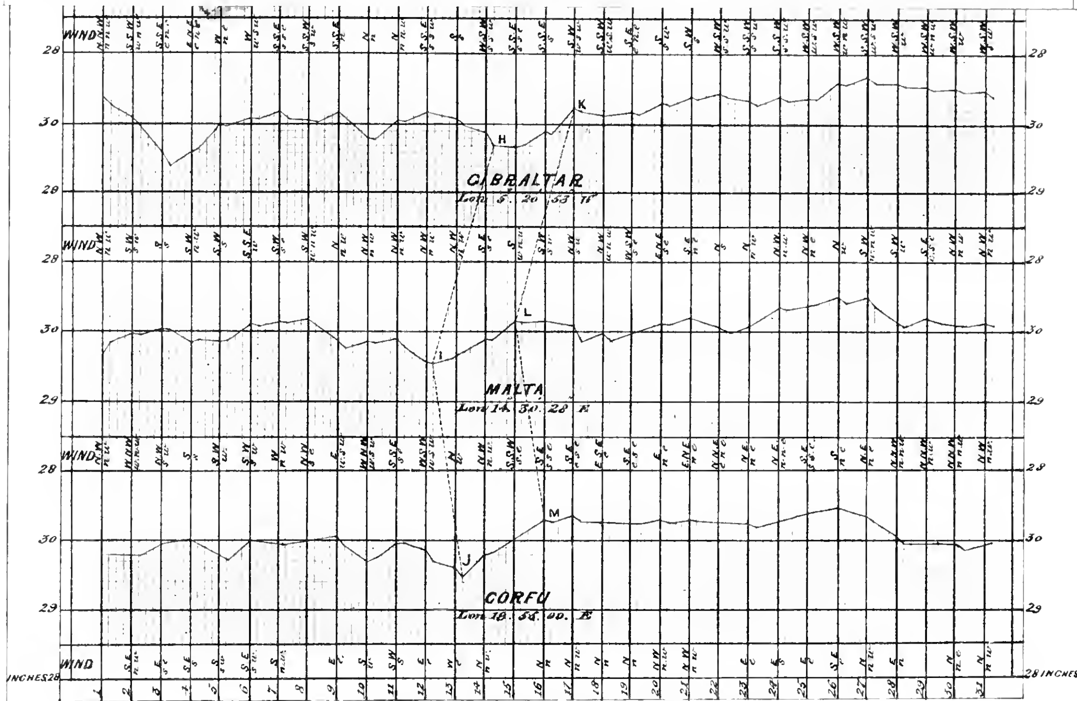
"Ask why all things turn sour and musty,
Ask why the Mail's not arrived yet,
Ask why every thing outside is dusty
While every thing in-doors is wet;
Ask why such a one murdered his brother,
For the act if a reason you'd find,
'Tis the same cause that serves every other,
'Tis that horrible easterly wind.
Aie! Aie! Aie! Aie! Aie! Aie!—what a pity
That an east wind should spoil such a city!"

FINIS.

LONDON:
Printed by George E. Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.

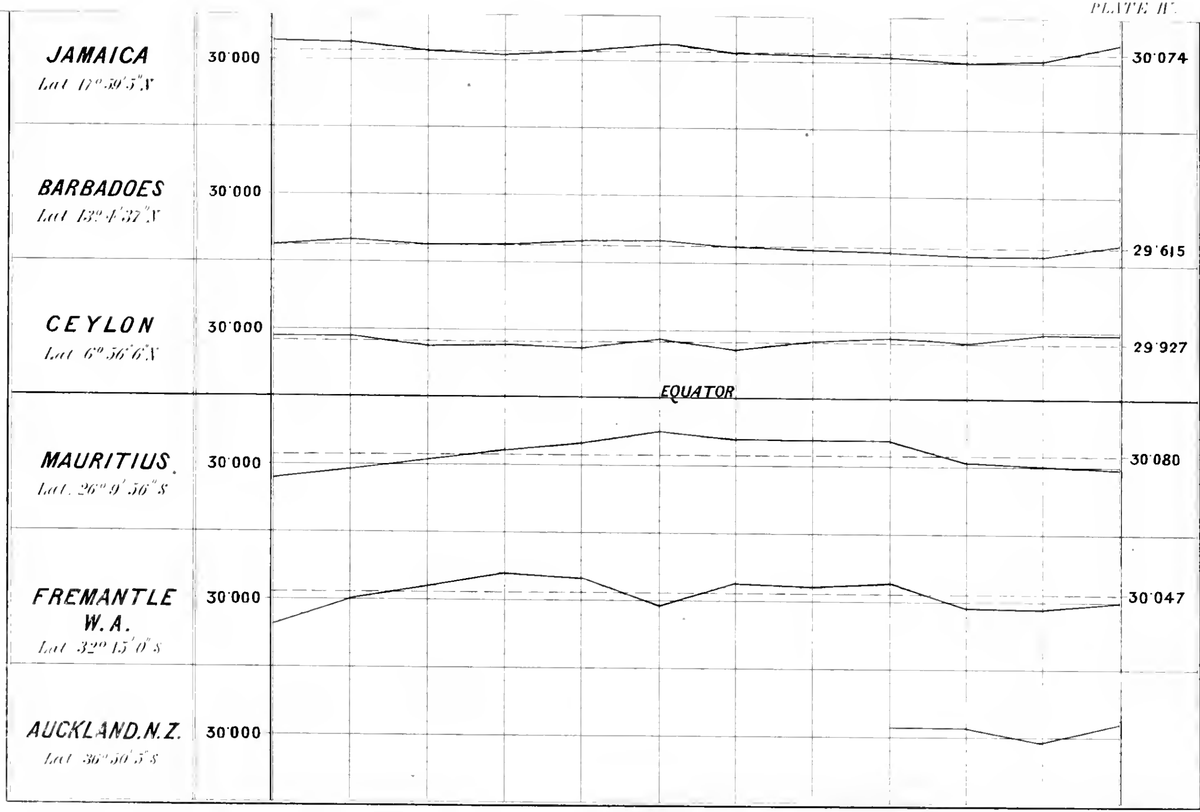
PLATE II.

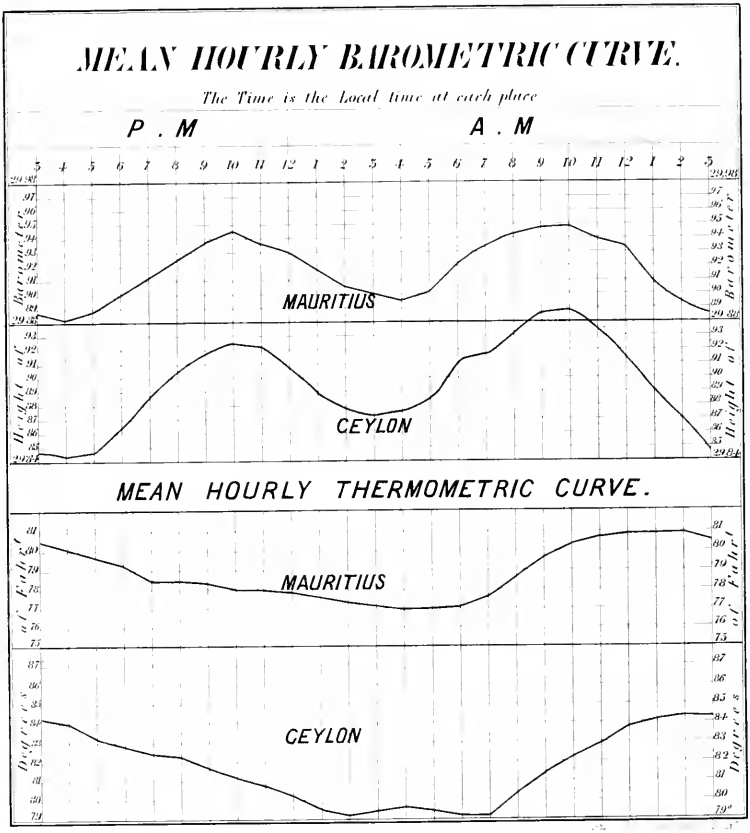
DIAGRAM OF BAROMETRIC PRESSURE



NOTE The readings of the Barometers have been reduced to the temperature of 32° and corrected for altitude above the mean level of the sea.

Major Henry James R.E. delt.


JAMAICA
Lat 17° 59' 5" N
30·000
30·074
BARBADOES
Lat 13° 4' 37" N
30·000
29·615
CEYLON
Lat 6° 56' 6" N
30·000
29·927
EQUATOR
MAURITIUS.
Lat. 26° 9' 56" S
30·000
30·080
FREMANTLE
W. A.
Lat 32° 15' 0" S
30·000
30·047
AUCKLAND. N. Z.
Lat 36° 50' 5" S
30·000



The readings of the Barometer have been reduced to the temperature of 32° and corrected for altitude above the mean level of the sea